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## P R E F A C E

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This index though arranged alphabetically retains the grouping of the subjects used in the *International Review*.

Except in the case of the original articles, which are numbered according to their pages, the numbers of each subject refer to the paragraphs in the *International Review*.

The index consists of three parts: one of the original articles, one concerned with Agricultural Intelligence and the last with Plant Diseases.

In case of errors in the Bulletin with reference to scientific terms and the names of authors, it should be noted that the correct spelling can be relied upon in the Index (See Errata).

The Table used for the conversion of the Weights, Measures and Money values of the various countries to the Metric System is included. A list is also given of the Periodical Publications reviewed by the Bureau.

This Index was prepared by redacteurs : Dr. Giulio Provenzal and Prof. Giulio Trinchieri, the latter compiled the Index of Plant Diseases. The whole was adapted to the English Edition by rédactrice Miss M. L. Yeo.

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# ERRATA

## AUTHORS.

Erratum	Correction
Cbneroff L. H.	Chernoff L. H.

## AGRICULTURAL INTELLIGENCE.

No. of Review	Errata	Correction
79	<i>Podocnemis du merihana</i>	<i>Podocnemis dumerikiana</i>
138.	« Kuei Li-tzu » resistant to Blight	« Knei li-tzu » resistant to Bark disease.
628	<i>Chaetochloa Lindergiana</i>	<i>Chaetochloa Lindenbergiana</i>
772	<i>Duvana praecox</i>	<i>Duvaua praecox</i>
880	<i>Sphenocercus sororius</i>	<i>Sphenocercus sororius</i>
1075	<i>Guizotia abyssinica</i>	<i>Guizotia abyssinica</i>

## PLANT DISEASES.

No. of Review	Errata	Correction
118.	<i>Cybocephalus rufifrons</i>	<i>Cybocephalus rufifrons</i>
124.	<i>Quercus pigitata</i>	<i>Quercus digitata</i>
241.	<i>Anthonomus rubi</i>	<i>Anthonomus rubi</i>
»	<i>Apamea testacea</i>	<i>Apamea testacea</i>
»	<i>Applespinmalen</i>	<i>Applespinmalen</i>
»	<i>Blithophaga (Oiceoptoma) opaca</i>	<i>Blithophaga (Oiceoptoma) opaca</i>
»	<i>Dasyfolia templi</i>	<i>Dasyfolia templi</i>
»	<i>Erinaceus europeus</i>	<i>Erinaceus europaeus</i>
»	<i>Tetrao migallus</i>	<i>Tetrao urogallus</i>
242.	<i>Styctococcus sjöstedti</i>	<i>Stictococcus sjöstedti.</i>
244.	<i>Diaspis (Aulacapsis) pentagona</i>	<i>Diaspis (Aulacapsis) pentagona</i>
»	<i>Doryalis caffra</i>	<i>Doryalis caffra</i>
366.	<i>Arbustus Unedo</i>	<i>Arbutus Unedo</i>
487.	<i>Aphis mathiolae</i>	<i>Aphis mathiolae</i>
»	<i>Aphis mathiolellae</i>	<i>Aphis mathiolellae</i>
495.	<i>Eniglaea apiata</i>	<i>Eniglaea apiata</i>
»	<i>Oxyococcus macrocarpus</i>	<i>Oxyococcus macrocarpus</i>
586.	<i>S. Simasii</i>	<i>Puccinia Simasii</i>
933.	<i>Aleurothrixus (A.) floccosus</i>	<i>Aleurothrixus (A.) floccosus</i>
»	<i>Mechilia flava</i>	<i>Mechelia flava</i>
934.	<i>Idarnes carne</i>	<i>Idarnes carne</i>
»	<i>Grotiusomyia flavicornis</i> on Oat	<i>Gr. flavicornis</i> on Oak
1295.	<i>Cercospora latimaculatus</i>	<i>Cercospora latimaculans</i>
1311.	<i>Deciostaurus maroccanus</i>	<i>Dociostaurus maroccanus</i>
1315.	<i>Gelechia ocellata</i>	<i>Gelechia ocellatella</i>
1433.	<i>Bombyx</i>	<i>Bombyx</i>
1438.	<i>Laemophloeus sp.</i>	<i>Laemophleus sp.</i>

# V. — WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	=	27.99961 inches
1 Ardeb (Egypt)	=	5.44435 bushels
1 Ardeb of wheat (Egypt)	=	2.95264 cwt.
1 Ardeb of hulled maize (Egypt)	=	2.75580 cwt.
1 Ardeb of barley (Egypt)	=	2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt)	=	5.72812 cwt.
1 Ardeb of decorticated rice (Egypt)	=	3.83813 cwt.
1 Arpent (Canada)	=	0.84501 acre
1 Are [100 square metres]	=	107.63915 square feet
1 Arroba (Brazil)	=	33.06951 lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	=	25.35841 lbs.
1 Arroba (Mexico)	=	25.36687 lbs.
1 Bale of cotton (Brazil)	=	396.83415 lbs.
1 Bale of cotton (United States)	=	4.46431 cwt. (gross wt.)
1 " " " " "	=	4.26788 cwt (net wt.)
1 Bale of cotton (India)	=	3.57145 cwt.
1 Barrel of wheat flour (Canada, United States)	=	1.75001 cwt.
1 Bar, see Millier		
1 Bow (Java, Dutch Indies)	=	76.36998 square feet
1 Bushel (United States)	=	0.96896 bushels
1 Bushel of oats (United States)	=	32 lbs.
1 Bushel of oats (Canada)	=	34 lbs.
1 Bushel of wheat and potatoes (United States)	=	60 lbs.
1 Bushel of barley (Canada, United States)	=	48 lbs.
1 Bushel of raw rice (United States)	=	45 lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	=	56 lbs.
1 Cadastral arpent (Hungary)	=	1.42201 acres
1 Cental (United States)	=	100 lbs.
1 Centiare [10 square metres]	=	10.76392 square feet
1 Centigramme	=	0.15432 grains
1 Centilitre	=	0.0022 gallons
1 Centimetre	=	0.393715 inches
1 Centistere	=	0.35315 cubic feet
1 Centner (Germany, Austria, Denmark)	=	110.23171 lbs.
1 Centner (Sweden)	=	93.71238 lbs.
1 Cho [60 ken] (Japan)	=	119.30327 yards.
1 Cho (Japan)	=	2.45068 acres
1 Crown [100 heller] (Austria-Hungary)	=	10 d at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	=	1s 1 1/2 d at par
1 Cubic centimetre	=	0.06102 cubic inch
1 Cubic metre	=	1.30795 cubic yards
1 Decagramme [10 grammes]	=	0.35275 oz.

1 Decalitre [10 litres]	= 2.19976 gallons
1 Decametre [10 metres]	= 32.80840 feet
1 Decare [1000 square metres]	= 1195.98627 square yards
1 Decastere [10 cubic metres]	= 13.07951 cubic yards
1 Deciare [10 square metres]	= 11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	= 2.69966 acres
1 Decigramme	= 1.54323 grains
1 Decilitre	{ = 0.022 gallons
	{ = 0.0027497 bushels
1 Decimetre	= 3.93701 inches
1 Decistere	= 3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Dollar, gold, \$ [100 cents] (United States)	= 48 <sup>1</sup> / <sub>100</sub> d at par
1 Drachm, gold [100 lepta] (Greece)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Dz. = Doppelzentner (Germany)	= 220.46341 lbs.
1 Egyptian kantar (Egypt)	= 99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	= 1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	= 18 <sup>7</sup> / <sub>100</sub> d at par
1 Franc [100 centimes] (France)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Gallon (United States)	= 0.83270 gallons
1 gramme	= 0.03527 oz.
1 Hectare [10 000 square metres]	= 2.47109 acres
1 Hectogramme (100 grammes)	= 3.52746 oz.
1 Hectolitre [100 litres]	{ = 21.99755 gallons
	{ = 2.74967 bushels
1 Hectometre [100 metres]	= 109.36133 yards
1 Hectostere [100 cubic metres]	= 130.79505 cubic yards
1 Jarra (Mexico)	= 7.22642 quarts
1 Kadastral hold, see Cadastral arpent	
1 Kin (Japan)	= 1.32278 lbs.
1 Kokou [10 to] (Japan)	= 1.58726 quarts
1 Kokou of oats (Japan)	= 1.55014 cwt.
1 Kokou of cocoons (Japan)	= 82.67268 lbs.
1 Kokou of wheat and maize (Japan)	= 2.58356 cwt.
1 Kokou of barley (Japan)	= 2.06685 cwt.
1 Kokou of naked barley (Japan)	= 2.69428 cwt.
1 Kokou of rice (Japan)	= 2.80501 cwt.
1 Kopek (Russia)	= 1 <sup>1</sup> / <sub>100</sub> farthing at par
1 Kwan (Japan)	= 8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Leu [100 statinki] (Bulgaria)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Lira [100 centesimi] (Italy)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Litre	{ = 0.21998 gallons
	{ = 0.0275 bushels
1 Manzana (Nicaragua, Guatemala)	= 1.72665 acres
1 Mark [100 Pfennige] (Germany)	= 11 <sup>1</sup> / <sub>100</sub> d at par
1 Mark [100 penni] (Finland)	= 9 <sup>33</sup> / <sub>100</sub> d at par
1 Maund Factory (India)	= 74.6709 lbs.

1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	{	= 2 199.75539 gallons
		= 274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2 s 2 <sup>31</sup> / <sub>100</sub> d at par
1 Milreis, gold (Portugal)	=	4 s 5 <sup>31</sup> / <sub>100</sub> d at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Cape of good Hope)	=	2.11654 acres
1 Muid (Cape of good Hope)	{	= 24 gallons
		= 3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 <sup>31</sup> / <sub>100</sub> d at par
1 Peso, gold [100 centavos] (Argentina)	=	3 s 11 <sup>31</sup> / <sub>100</sub> d at par
1 Peso, gold [100 centavos] (Chili)	=	1 s 5 <sup>31</sup> / <sub>100</sub> d at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1.0.6 <sup>42</sup> / <sub>100</sub> at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18 s 0 <sup>31</sup> / <sub>100</sub> d at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2 s 1 <sup>31</sup> / <sub>100</sub> d at par
1 Rupee, silver [16 annas] (British India)	=	1 s 4 d at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1 s 11 <sup>31</sup> / <sub>100</sub> d at par
1 Talari [20 piastres] (Egypt)	=	4 s 1 <sup>31</sup> / <sub>100</sub> d at par
1 To (Japan)	{	= 0.49601 bushels
		= 3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2 s 0 <sup>31</sup> / <sub>100</sub> d at par
1 Zentner (Germany)	=	110.23171 lbs.





IV. — PERIODICAL PUBLICATIONS REVIEWED  
BY THE BUREAU OF AGRICULTURAL INTELLIGENCE  
AND PLANT DISEASES. \*

ARGENTINE.

*Agronomía*. Buenos Aires.  
*Anales de la Sociedad rural argentina*.  
Buenos Aires.  
*Anuario de la Dirección general de Estadística*. Buenos Aires.  
*Anuario estadístico. República Argentina*. Buenos Aires.  
*Argentine (The) Year-Book*. London.  
*Boletín de Agricultura*. Córdoba.  
*Boletín mensual del Museo Social Argentino y Boletín bibliográfico mensual (anexo al Bol. mens. d. Museo Soc. Arg.)*. Buenos Aires.  
*Boletín de Obras Públicas de la República Argentina*. Buenos Aires.  
*Boletín de la Sociedad Forestal Argentina*. Buenos Aires.  
*Campo (El)*. Buenos Aires.  
*Comercio (El) exterior argentino*. Buenos Aires.  
*Gaceta rural*. Buenos Aires.  
*Ministerio de Agricultura de la Nación. Dirección general de Enseñanza e Investigaciones agrícolas*: 1. *Boletín*. — 2. *Circulares*. — 3. *Publicaciones*. Buenos Aires.  
*Ministerio de Relaciones exteriores y Culto*: 1. *Boletín*. — 2. *Circular informativa mensual*. Buenos Aires.  
*Monitor de Sociedades anónimas y Patentes de Invencción*. Buenos Aires.  
*Review (The) of the River Plate*. Buenos Aires.

*Revista del Centro Estudiantes de Agronomía y Veterinaria de la Universidad de Buenos Aires*. Buenos Aires.  
*Revista de Ciencias Económicas*. Buenos Aires.  
*Revista Industrial y Agrícola de Tucumán*. Tucumán.  
*Revista de la Facultad de Agronomía y Veterinaria*. Buenos Aires.  
*Revista (La) de la Liga agraria*. Buenos Aires.  
*Revista Forestal*. Buenos Aires.  
*Revista de la Sociedad rural de Córdoba*. Córdoba.  
*Universidad de Tucumán. Informe del Departamento de Investigaciones industriales*. Tucumán.

AUSTRALIA.

*Agricultural (The) Gazette of New South Wales*. Sydney.  
*Agricultural (The) Gazette of Tasmania*. Hobart.  
*Annual Report. Department of Agriculture and Industries of Western Australia*. Perth.  
*Annual Report. Department of Lands and Survey. South Australia*. Adelaide.  
*Annual Report. Papua*. Melbourne.  
*Annual. Royal Agricultural Society of New South Wales*. Sydney.

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\* A certain number of these publications have not been received regularly during the war. The Library made the necessary arrangements in connection with the renewal of subscriptions and the exchange with the Institute publications. (Ed.)

*Australian (The) Farm & Home.* Melbourne.

*Australian Museum. Records.* Sydney.

*Australian (The) Sugar Journal.* Brisbane.

*Australian (The) Zoologist.* Sydney.

*Bulletin of the Department of Agriculture, Western Australia.* — Idem:

*Division of Botany and Plant Pathology, Entomological Section.* Perth.

*Bulletin of the Department of Intelligence, South Australia.* Adelaide.

*Chemist (The), Druggist and Pharmacist of Australasia.* Melbourne.

*Dalgety's Review.* Sydney.

*Fertilizer (The).* Sydney.

*Fruit (The) World of Australasia.* Melbourne.

*Government Gazette of Western Australia.* Perth.

*Institute of Science and Industry. Bulletin.* Melbourne.

*Journal of the Department of Agriculture of South Australia.* Adelaide.

*Journal of the Department of Agriculture of Victoria.* Melbourne.

*Land (The).* Sydney.

*Motor (The) in Australia.* Sydney.

*New South Wales. Department of Agriculture: 1. Farmers' Bulletin.*

— 2. *Science Bulletin.* Sydney.

*Pastoralists (The) Review.* Melbourne.

*Producer's Review.* Perth.

*Quarterly Summary of Australia Statistics.* Melbourne.

*Queensland (The) Agricultural Journal.* Brisbane.

*Queensland. Bureau of Sugar Experiment Stations. Division of Entomology: 1. Bulletin — 2. General Series Bulletin.* Brisbane.

*Queensland Government Gazette.* Brisbane.

*Report. Agricultural and Stock Department. Parliament of Tasmania.* Hobart.

*Review of Reviews for Australasia.* Melbourne.

*Science and Industry.* Melbourne.

*South Australia. Department of Agriculture. Bulletin.* Adelaide.

*South (The) Australian Government Gazette.* Adelaide.

*Tasmania. Agricultural and Stock Department. Bulletin.* Hobart, Tasmania.

*Victorian Year Book.* Melbourne.

*Western Australia Year Book.* Perth.

*Year Book (The Official) of New South Wales.* Sydney.

*Year Book (Official) of the Commonwealth of Australia.* Melbourne.

# AUSTRIA.

*Allgemeine Wein-Zeitung.* Wien.

*Akademie (Kaiserliche) der Wissenschaften. Sitzungen der math. naturw. Klasse.* Wien.

*Allgemeine Zeitschrift für Bierbrauerei und Malzfabrikation.* Wien.

*Archiv für Chemie und Mikroskopie.* Wien.

*Berichte der k. u. k. österr. - ung. Konsularämter.* Wien.

*Bericht über die Tätigkeit der k. k. landw. - chemischen Versuchsstation und der mit ihr vereinigten k. k. landw. - bakteriologischen und Pflanzenschutzstation in Wien.* Wien-Leipzig.

*Centralblatt für das gesamte Forstwesen.* Wien.

*Continentale Holz-Zeitung.* Wien.

*Deutsch-oesterreichische agrar-Zeitung.* Wien.

*Handelsmuseum (Das).* Wien.

*Illustrierte Monatsblätter für Bienenzucht.* Wien.

*Jahrbuch der k. k. geologischen Reichsanstalt.* Wien.

*Jahrbuch der k. - k. Landwirtschaftsgesellschaft in Wien.* Wien.

*Jahrbuch der österreichischen Industrie.* Wien.

*Jahresbericht der k. - k. Samenkontrollstation in Wien.* Wien.

*Jahrbücher der k. - k. zentral-Anstalt für Meteorologie und Geodynamik.* Offizielle Publikation. Wien.

*Landes-Amisblatt des Erzherzogtums Oesterreich u. d. Enns.* Wien.

*Land- und volkswirtschaftliche Mitteilungen.* Linz.

*Landwirtschaftliche Mitteilungen für Kärnten.* Klagenfurt.

*Landwirtschaftliche Zeitschrift.* Wien.

*Landwirtschaftliche Zeitschrift für Ober-oesterreich.* Linz.

*Milchwirtschaftliche Zeitung.* Wien.

*Mitteilungen der Fachberichterstattung des k. k. Ackerbauministeriums.* Wien.

*Mitteilungen des k. k. Ackerbauministeriums über Pferdezucht-Angelegenheiten.* Wien.

*Mitteilungen der k. k. Gartenbau-Gesellschaft in Steiermark.* Graz.

*Mitteilungen des Landeskulturrates für Vorarlberg.* Bregenz.

*Mitteilungen der landwirtschaftlichen*

*Lehrkanzeilen der k. k. Hochschule für Bodenkultur in Wien.* Wien.  
*Mitteilungen des Zuchtvereines für das Alpine Grauwieh in Steiermark.* Graz.  
*Monatshefte für Landwirtschaft.* Wien.  
*Obstzüchter (Der).* Wien.  
*Oesterreichische agrar-Zeitung.* Wien.  
*Oesterreichische botanische Zeitschrift.* Wien.  
*Oesterreichische Fischerei-Zeitung.* Wien.  
*Oesterreichische Forst- und Jagdzeitung.* Wien.  
*Oesterreichische Garten-Zeitung.* Wien.  
*Oesterreichische Molkerei-Zeitung.* Wien.  
*Oesterreichische Monatsschrift für den Orient.* Wien.  
*Oesterreichische Moorzeitschrift.* Staab.  
*Oesterreichisch-ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft.* Wien.  
*Oesterreichische Vierteljahresschrift (früher Monatsschrift) für Forstwesen.* Wien.  
*Pferdezüchter (Der).* Graz.  
*Samenkontrollstation (K. K.). Publikationen.* Wien.  
*Statistisches Jahrbuch des k. k. Ackerbauministeriums.* Wien.  
*Tiroler landwirtschaftliche Blätter.* Innsbruck.  
*Vereinschrift für Forst- Jagd- und Naturkunde.* Wien.  
*Verhandlungen der k. k. geologischen Reichsanstalt.* Wien.  
*Volkswirtschaftliche Chronik der Oesterreichisch-Ungarischen Monarchie.* Wien.  
*Wiener landwirtschaftliche Zeitung.* Wien.  
*Wochenschrift des Zentralvereines für die Rübenzucker-Industrie Österreichs und Ungarns.* Wien.  
*Zitschrift des Österr. Ingenieur u. Architekten-Vereines.* Wien.  
*Zeitschrift für das landwirtschaftliche Versuchswesen in Deutschösterreich.* Wien.  
*Zeitschrift für Moorkultur und Torfverwertung.* Wien.  
*Zentralblatt für das gewerbliche Unterrichtsweisen in Oesterreich.* Wien.

#### BELGIUM AND BELGIAN CONGO.

*Académie royale de Belgique. Bulletin de la Classe des Sciences.* Bruxelles.  
*Agronomie (L') tropicale.* Uccle-lez-Bruxelles.  
*Annales de Gembloux.* Bruxelles.  
*Annales de l'Observatoire royal de Bru-*

*xelles, publiés aux frans de l'Etat y Annuaire météorologique.* Bruxelles.  
*Annales de Médecine Vétérinaire.* Bruxelles.  
*Annales du Musée du Congo belge. (Ministère des Colonies).* Bruxelles.  
*Annuaire de la Belgique scientifique, artistique, et littéraire.* Bruxelles.  
*Annuaire de la Vie internationale.* Bruxelles.  
*Annuaire de l'Institut international de Bibliographie.* Bruxelles.  
*Annuaire officiel. Ministère des Colonies.* Bruxelles.  
*Annuaire statistique de la Belgique et du Congo belge.* Bruxelles.  
*Belgique horticole et agricole.* Bruxelles.  
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# WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES WITH THEIR ENGLISH EQUIVALENTS.

1 Archine (Russia)	= 27.99961 inches
1 Ardeb (Egypt)	= 5.44435 bushels
1 Ardeb of wheat (Egypt)	= 2.95264 cwt.
1 Ardeb of hulled maize (Egypt)	= 2.75580 cwt.
1 Ardeb of barley (Egypt)	= 2.36211 cwt.
1 Ardeb of undecorticated rice (Egypt)	= 5.72812 cwt.
1 Ardeb of decorticated rice (Egypt)	= 3.83843 cwt.
1 Arpent (Canada)	= 0.84501 acre
1 Are [100 square metres]	= 107.63915 square feet
1 Arroba (Brazil)	= 33.06951 lbs.
1 Arroba (Cuba, Guatemala, Paraguay, Peru)	= 25.35841 lbs.
1 Arroba (Mexico)	= 25.36697 lbs.
1 Bale of cotton (Brazil)	= 396.83415 lbs.
1 Bale of cotton (United States)	= 4.46431 cwt. (gross wt.)
1 " " " " "	= 4.26788 cwt. (net wt.)
1 Bale of cotton (India)	= 3.57145 cwt.
1 Barrel of wheat flour (Canada, United States)	= 1.75001 cwt.
1 Bar, see Millier	
1 Bow (Java, Dutch Indies)	= 76.36998 square feet
1 Bushel (United States)	= 0.96896 bushels
1 Bushel of oats (United States)	= 32 lbs.
1 Bushel of oats (Canada)	= 34 lbs.
1 Bushel of wheat and potatoes (United States)	= 60 lbs.
1 Bushel of barley (Canada, United States)	= 48 lbs.
1 Bushel of raw rice (United States)	= 45 lbs.
1 Bushel of rye, hulled maize, linseed (Canada, United States)	= 56 lbs.
1 Cadastral arpent (Hungary)	= 1.42201 acres
1 Cental (United States)	= 100 lbs.
1 Centiare [10 square metres]	= 10.76392 square feet
1 Centigramme	= 0.15432 grains
1 Centilitre	= 0.0022 gallons
1 Centimetre	= 0.393715 inches
1 Centistere	= 0.35315 cubic feet
1 Centner (Germany, Austria, Denmark)	= 110.23171 lbs.
1 Centner (Sweden)	= 93.71238 lbs.
1 Cho [60 ken] (Japan)	= 119.30327 yards.
1 Cho (Japan)	= 2.45068 acres
1 Crown [100 heller] (Austria-Hungary)	= 10 d at par
1 Crown [100 öre] (Denmark, Norway, Sweden)	= 18 1 1/2 d at par
1 Cubic centimetre	= 0.06102 cubic inch
1 Cubic metre	= 1.30795 cubic yards
1 Decagramme [10 grammes]	= 0.35275 oz.

# X WEIGHTS, MEASURES AND MONEY OF THE VARIOUS COUNTRIES

1 Decalitre [10 litres]	=	2.19176 gallons
1 Decametre [10 metres]	=	32.80840 feet
1 Decare [1000 square metres]	=	1195.98627 square yards
1 Decastere [10 cubic metres]	=	13.07951 cubic yards
1 Deciare [10 square metres]	=	11.95986 square yards
1 Deciatine [2 tchetwert] (Russia)	=	2.69966 acres
1 Decigramme	=	1.54323 grains
1 Decilitre	{	= 0.022 gallons
		= 0.0027497 bushels
1 Decimetre	=	3.93701 inches
1 Decistere	=	3.53146 cubic yards
1 Dinar, gold [100 para] (Serbia)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Dollar, gold, \$ [100 cents] (United States)	=	48 1 <sup>1</sup> / <sub>16</sub> d at par
1 Drachm, gold [100 lepta] (Greece)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Dz. = Doppelzentner (Germany)	=	220.46341 lbs.
1 Egyptian kantar (Egypt)	=	99.04980 lbs.
1 Feddan Masri [24 Kirat Kamel] (Egypt)	=	1.03805 acres
1 Florin, gold, or Gulden [100 cents] (Netherlands)	=	18 7 <sup>1</sup> / <sub>64</sub> d at par
1 Franc [100 centimes] (France)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Gallon (United States)	=	0.83270 gallons
1 gramme	=	0.03527 oz.
1 Hectare [10 000 square metres]	=	2.47109 acres
1 Hectogramme (100 grammes)	=	3.52746 oz.
1 Hectolitre [100 litres]	{	= 21.99755 gallons
		= 2.74967 bushels
1 Hectometre [100 metres]	=	109.36133 yards
1 Hectostere [100 cubic metres]	=	130.79505 cubic yards
1 Jarra (Mexico)	=	7.22642 quarts
1 Kadastral hold, see Cadastral arpent		
1 Kin (Japan)	=	1.32278 lbs.
1 Kokou [10 to] (Japan)	=	1.58726 quarts
1 Kokou of oats (Japan)	=	1.55011 cwt.
1 Kokou of cocoons (Japan)	=	82.67268 lbs.
1 Kokou of wheat and maize (Japan)	=	2.58356 cwt.
1 Kokou of barley (Japan)	=	2.06685 cwt.
1 Kokou of naked barley (Japan)	=	2.69128 cwt.
1 Kokou of rice (Japan)	=	2.80501 cwt.
1 Kopek (Russia)	=	1 <sup>1</sup> / <sub>200</sub> farthing at par
1 Kwan (Japan)	=	8.26738 lbs.
1 Lei, gold [100 bani] (Rumania)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Leu [100 statinki] (Bulgaria)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Lira [100 centesimi] (Italy)	=	9 <sup>23</sup> / <sub>64</sub> d at par
1 Litre	{	= 0.21998 gallons
		= 0.0275 bushels
1 Manzana (Nicaragua, Guatemala)	=	1.72665 acres
1 Mark [100 Pfennige] (Germany)	=	11 <sup>1</sup> / <sub>4</sub> d at par
1 Mark [100 penni] (Finland)	=	9 <sup>23</sup> / <sub>64</sub> d at par

1 Maund Factory (India)	=	74.6709 lbs.
1 Maund Imperial (India)	=	82.28136 lbs.
1 Metre	=	3.28084 feet
1 Milliare	=	1.07639 square feet
1 Milligramme	=	0.01543 grains
1 Millilitre	=	0.00022 gallons
1 Millimetre	=	0.03937 inches
1 Millistere	=	61.02361 cubic inches
1 Myriagramme [10 000 grammes]	=	22.04634 lbs.
1 Myrialitre [10 000 litres]	{	- 2 199.75539 gallons
	{	= 274.96701 bushels
1 Myriametre [10 000 metres]	=	6.21373 miles
1 Millier [1 000 000 grammes]	=	19.68426 cwt.
1 Milreis, gold (Brazil)	=	2 s 2 <sup>11</sup> / <sub>16</sub> d at par
1 Milreis, gold (Portugal)	=	4 s 5 <sup>19</sup> / <sub>16</sub> d at par
1 Minot (Canada)	=	1.07306 bushels
1 Morgen (Cape of good Hope)	=	2.11654 acres
1 Muid (Cape of good Hope)	{	= 24 gallons
	{	= 3 bushels
1 Oka (Greece)	=	2.75579 lbs.
1 Oke (Egypt)	=	2.75138 lbs.
1 Peseta, gold [100 céntimos] (Spain)	=	9 <sup>23</sup> / <sub>16</sub> d at par
1 Peso, gold [100 centavos] (Argentina)	=	3 s 11 <sup>27</sup> / <sub>16</sub> d at par
1 Peso, gold [100 centavos] (Chili)	=	1 s 5 <sup>21</sup> / <sub>16</sub> d at par
1 Pic (Egypt)	=	2.46646 feet
1 Pikul (China)	=	133.27675 lbs.
1 Pikul (Japan)	=	132.27805 lbs.
1 Poud (Russia)	=	36.11292 lbs.
1 Pound, Egyptian, gold [100 piastres]	=	£1.0.6 <sup>40</sup> / <sub>16</sub> at par
1 Pound, Turkish, gold [100 piastres] (Ottoman Empire)	=	18 s 0 <sup>21</sup> / <sub>16</sub> d at par
1 Pund (Sweden)	=	0.93712 lbs.
1 Quintal	=	1.96843 cwt.
1 Rouble, gold [100 kopeks] (Russia)	=	2 s 1 <sup>1</sup> / <sub>16</sub> d at par
1 Rupee, silver [16 annas] (British India)	=	1 s 4 d at par
1 Square metre	=	1.19599 square yards
1 Stere [1 cubic metre]	=	1.30795 cubic yards
1 Sucre, silver (Ecuador)	=	1 s 11 <sup>21</sup> / <sub>16</sub> d at par
1 Talari [20 piastres] (Egypt)	=	4 s 1 <sup>12</sup> / <sub>16</sub> d at par
1 To (Japan)	{	= 0.49601 bushels
	{	= 3.96815 gallons
1 Ton (metric)	=	0.98421 tons
1 Verst (Russia)	=	1166.64479 yards
1 Yen, gold [2 fun or 100 sen] (Japan)	=	2 s 0 <sup>27</sup> / <sub>16</sub> d at par
1 Zentner (Germany)	=	110.23171 lbs.





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FIRST PART.  
ORIGINAL ARTICLES

The Forest Industry in Sweden

by

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For hundreds of years timber has held an important place among Swedish exports, but it was only towards the middle of the 19th. century that the exportation of this article increased considerably with the demand for sawn timber rather than unhewn timber (spars, etc.) or squared timber (beams, quarters).

In 1913 the values of the woods exported by Sweden were as follows:

Rough hewn timber, . . . . .	£	1 150 059. 12. s. 2 d.
Sawn, unplanned timber . . . . .	"	7 598 137. 11. 2
Planed and other worked woods (including joinery). . .	"	3 114 454. 11. 1
Wood pulp for paper . . . . .	"	5 489 529. 6. 9
Total . . . . .	£	1 735 2181. 1. 2

This sum represented about  $\frac{2}{5}$  ths. of the total value of Swedish exports.

The raw materials used in the Swedish saw-mills consist essentially of soft wood — Scotch pine and spruce. About  $\frac{2}{5}$  ths. pine and a little more than  $\frac{2}{5}$  ths. spruce are used for making planks, and boards (planed or unplanned). Staves are made chiefly with wood of deciduous trees.

FLOATING THE WOOD. — Although much wood may be carted directly, or sent by rail, from the place where it is felled to the saw-mills, floating is the most important means of transport, and the high place occupied by Sweden in the international timber trade is primarily due to its many water-courses well adapted for floating wood. The largest rivers of northern

Sweden rise in the high mountains and are sufficiently well fed by the ice and snow for wood to be floated down them throughout the summer. In southern Sweden, on the other hand, it often happens that there is only sufficient water for floating when the rivers are swollen in the spring, or that mills and other works prevent the use of this method. Nevertheless, floating is very common, particularly in the north.

Besides the considerable economy in labour and cost of transport, floating has an additional advantage in that wood which has been some months in the water does not warp so easily after sawing as wood sawn immediately after being cut, and has a more uniform colour. On the other hand, the washing of the resin which takes place during floating decreases the life of the wood.

In order that floating may be carried out without hinderance and that the largest quantities of wood may be transported by the water available, the water-courses, especially the smallest ones, have been dredged and provided with various constructions such as dikes or sluices to regulate the level of the water in the reservoirs, iron or wooden pipes for guiding the wood in shallow rapids, bars for preventing the wood from catching on to the banks, chains for collecting and sorting the wood. For transport on lakes or other smooth water the logs are enclosed, sometimes many thousands at a time, in a frame of large trunks joined together.

These works are carried out by the owner of the forest if he owns both the water used for floating and the wood to be transported, but, as a rule, the streams are public transport ways, generally divided by the State, each being administered by a "Floating Association", which takes charge of the floating in return for the payment of a tax fixed by the provincial government, the expenses, including the amortization of the cost of installation, being divided amongst the owners of the wood floated. In proportion as this amortization progresses, the cost of floating naturally diminishes. The cost varies considerably according to the amount of water available and the quantity of wood to be floated; on large water-courses it amounts to about 0.124 *d.* to 0.496 *d.* per mile per cubic metre (1), but on small water-courses it is much higher. The total length of the water-courses available for floating in Sweden is estimated at 16 146 miles, of which 14 283 are in the north of the country, above the river Dalälven.

**TIMBER SAWING.** — Although carried out since the middle ages, the sawing and exportation of timber only developed to a large extent toward the middle of the 19th. century, when a more liberal commercial legislation, the suppression of export dues, and, at the same time, the increasing demand for sawn wood, gave a great impulse to this industry. Its development was also favoured by the abundant water power available. Thus, a fairly large number of saw-mills with multiple frames were built in the northern, wooded parts of Sweden ("Norrländ"), particularly near waterfalls and the coast. The fact that it was impossible to build these mills actually

(1) 1 cubic metre = 35.317 cubic feet

on the coast was a drawback, since, in order to ship the sawn wood, it was necessary, either to cart it, tow it to a neighbouring port, which was fairly expensive, or also to float it, which spoilt the appearance and quality of the goods.

In this respect a complete revolution was effected when *steam saw-mills* were built *on the coast*. These gave the following advantages: — abolition of the long and costly transport from the mill to the port; increased capacity of production; better products; abolition of interruptions in the work in water saw-mills caused by freezing in winter and lack of water in summer. The first of these steam mills was built in 1851 at Vifsta, near the town of Sundsvall, and their number increased rapidly.

According to the latest available data, there were in Sweden, in 1913, 1053 industrial saw-mills and machine planing works, without counting a certain number of small mills for home use, worked either by hydraulic or steam power. The total cost of building the former has been estimated at 199 024 488 *crowns* (1 *crown* = 1s. 1d. *at par*), thus greatly exceeding the capital required for erecting any other kind of works. The value of the products may be placed at 216 million *crowns*, including the wood and charcoal sold; to this should be added 1 124 684 *crowns*, which represent the value of materials worked.

The number of workmen employed in the industry was 44 150; 1659 frames and 905 planing machines were used. As motive power were used: water-wheels, up to 1040 HP.; water-turbines of 14617 HP.; steam engines of 82 135 HP.; steam turbines of 2 246 HP.; oil and gas engines of 476 HP. Most of this power was used directly for working the machine saws, and the rest (21 949 HP.) for generating electricity for the motors.

The edges and ends of the wood sawn are trimmed with a circular saw, worked either by hand or by electric motor. This only applies to large mills, which have moving platforms worked by electricity for the automatic transport of the wood from the piles to the saws.

Sawn pine wood is often divided into five classes of different qualities, a very delicate operation. On the other hand, most of the spruce wood is shipped without being classed.

Many mills have planing works attached to them, for, in Sweden, planing rarely forms an independent industry, as is usually the case in Norway.

The chief machine saw-mills are those of Mo, Kramfors, Vifsta (the oldest), Skönvik, Bergvik, Korsnäs (or Bomhus) and Skutskär. Kramfors is on the navigable river Älgermanälven, along the lower course of which are numerous saw-mills. All the other places follow each other from the north to the south in the order in which they are named, along the coast of the gulf of Bothnia. There is no doubt that the Korsnäs and Skutskär mills, between Gevle and the mouth of the Dalälven, are the largest in Europe. They have 30 and 24 frames respectively, and each ships annually sawn timber wood estimated at 40 000 Petrograd *standards* (1 *standard* = 165 cubic feet for sawn timber).

In northern Sweden (provinces to the north of the Dalälven) there are only about a third of all the mills in the country, but they supply about  $\frac{2}{3}$  of the

of the total production. The northern part of the country has a still greater preponderance in exportation, for, in the more populous southern part, a larger fraction of the products of the mills is sold for home consumption.

In 1913 the total production of the Swedish saw-mills was 6 853 455 cubic metres, distributed as follows :

Unplaned planks and boards . . . . .	1 693 990 cubic metres
Planed planks . . . . .	1 210 159
Pieces of planks and boards . . . . .	358 353
Leaves and laths . . . . .	99 383
Planks for cases . . . . .	302 678
Staves . . . . .	188 397

6 853 155 cubic metres

In addition to these there are some smaller articles, of which the statistics give the value but not the quantity.

In 1913, 6 877 825 cubic metres of rough, squared and sawn wood were exported. Table I shows the distribution per category and country to which it was exported. During the period 1906-1910, the average amount exported annually was 6 052 000 cubic metres.

Table I shows that the net amount exported in 1913 almost equalled the total production of the mills, but it must be noted that it also includes unhewn wood. In 1914 and 1915 the timber trade was adversely affected on account of the war, and exportation decreased for most kinds of timber. For sawn timber this decrease was about  $\frac{1}{5}$  th. of the quantity exported in 1913.

TABLE I. — *Quantities of rough, squared and sawn timber exported from Sweden in 1913 (in cubic metres).*

Destination	Unplaned planks and boards	Planed planks *	Beams and rafters	Unhewn wood	Wood for mines	Other varieties	Total
Norway. . . . .	121 148	46 544	2 146	124 410	4 179	78 152	381 609
Denmark and Iceland . . . . .	404 732	87 548	181 538	5 721	1 516	107 595	788 670
United Kingdom . . . . .	1 117 684	392 133	21 893	19 796	532 527	521 367	2 605 400
Netherlands . . . . .	247 668	27 371	27 240	17 186	7	34 054	358 626
Germany . . . . .	584 338	7 219	110 946	49	711	26 191	729 435
France . . . . .	908 074	341	21 446	754	—	17 992	948 607
Italy . . . . .	9 761	—	3 481	1 596	—	—	14 838
Other European countries . . . . .	384 914	6 951	16 445	31	3	29 200	437 550
Egypt . . . . .	35 238	4 679	53 075	439	—	111	93 572
British Africa . . . . .	111 420	54 131	—	30	—	1 754	167 335
Australia . . . . .	19 901	78 598	—	—	—	274	98 773
Other countries . . . . .	199 114	43 946	9 110	72	990	337	253 389
<i>Total</i>	<b>4 143 992</b>	<b>749 261</b>	<b>447 340</b>	<b>170 184</b>	<b>544 934</b>	<b>822 113</b>	<b>6 877 824</b>

\* Including boards for packing-cases

A branch of the timber industry which has recently inspired a certain nervousness, is the exportation of mine props, as it is feared, not without

reason, that this may depopulate the forests. The felling of wood for such props would have no harmful effect if only trees of medium value which might be considered as useless for the rational preservation of the forest, were used ; on the other hand it becomes very serious when, as often happens, whole young plantations are felled.

Mine props are chiefly exported from southern Sweden, which supplies the greater part of the wood used for this purpose ; Norrland (northern Sweden) in particular, also exports a large amount. These props are exported almost exclusively to England.

**WOOD PULP AND CELLULOSE INDUSTRY.** — This, together with timber-sawing, though a little later, has developed into a flourishing industry, taking 2nd. place as regards value of production. As is well known, wood pulp is divided into two principal varieties according to the method of preparation : 1) *mechanical*, obtained by disintegrating the wood by a runner, under a continuous stream of water ; 2) *chemical*, or wood cellulose, obtained by disintegrating the wood by chemical solutions : *a*) sodium sulphate (sulphate cellulose) ; *b*) calcium or magnesium bisulphite (bisulphite cellulose). On the other hand, *semi-chemical* wood-pulp is that obtained by first boiling the wood in water, so as to eliminate part of the incrustation, then breaking it up by a mechanical process. This pulp, sometimes called unbleached (brown), is very strong, but, owing to its dark colour, cannot be used for fine paper.

As raw material, spruce is especially used in Sweden (it is used almost exclusively for bisulphate pulp), and also a little pine and aspen wood.

The first mechanical wood-pulp factory was founded in 1857 at Trollhättan. The manufacture of chemical pulp is of more recent date, but has surpassed that of mechanical pulp. The wood-pulp industry, long confined to the south and west of Sweden, has spread greatly, during the last decades, in Norrland and Dalecarlie, where it has been adopted by many large saw-mills in addition to their own principal industry, thus allowing them to utilise small pieces of wood and waste, and to effect the necessary thinning of their forests with greater economic advantage. The development of the cellulose industry has been aided of recent years by a better utilisation of the by-products : alcohol from the waste waters of bisulphite cellulose, oil of turpentine, etc.

It seems that the manufacture of alcohol might be developed ; in 1913, 4 million litres at 50 % were produced, but it has been estimated that the Swedish wood-pulp factories could produce annually 26 million litres of 100 % alcohol.

In 1913 there were in Sweden 167 wood-pulp factories distributed as follows :

Product	No. of factories
Mechanical wood-pulp . . . . .	83
Mechanical pulp and chemical pulp. . .	17
Chemical sulphate pulp . . . . .	17
Chemical bisulphite pulp . . . . .	49
Sulphate pulp and bisulphite pulp. . .	1
	<hr/> 167

The production (expressed in dry matter) was estimated at 1 186 577 tons, of which 326 098 tons were mechanical pulp, 705 099 tons bisulphite pulp and 155 430 tons sulphate pulp. The total value of this production was about 126 million *crowns*.

During the year 1 009 358 tons of paper pulp were exported ; this corresponded to 847 137 tons of dry matter. With the exception of a negligible quantity of rag pulp, this was all wood pulp, divided as follows into the various categories :

Mechanical pulp. . .	{	moist . . . . .	261 049	metric tons
		dry . . . . .	59 198	
Bisulphite pulp. . .	{	bleached . . . . .	20 690	
		unbleached moist . . . . .	58 548	
		» dry . . . . .	508 134	
Sulphate pulp. . . .	{	bleached . . . . .	10 972	
		unbleached moist . . . . .	1 846	
		» dry . . . . .	85 921	
			<hr/> 1 009 358	metric tons

**CHARCOAL.** — This has been prepared in Sweden since remote times, and has always found regular markets near the place in which it is produced. It is used for iron smelting (blast furnaces and forges), for which it is necessary.

It is prepared by the old pile-method, but also sometimes in ovens, either in metallurgical works or in other places favourably situated for the collection of wood and the forwarding of the charcoal. The manufacture of charcoal on a large scale in piles in the forests is due to the facility with which it may be transported in winter on sledges, thus avoiding the necessity of constructing costly ways of communication. Where it is necessary to transport large quantities of charcoal to metallurgical works by means of floating, it is best prepared in ovens. Many saw-mills of northern and southern Sweden prepare charcoal with their wood waste, either in piles or in ovens.

Recently the charcoal industry has begun to compete with the wood-pulp industry in the purchase of raw materials. This, together with the rise in wages, has caused a notable rise in the price of charcoal, which has necessitated a restriction of its use by applying various new metallurgical methods, which have succeeded fairly well. Nevertheless, charcoal is still a very important commercial article.

The woods used are spruce and pine. The charring is carried out in either vertical or horizontal piles, so called according to the way in which the wood is piled up. Two parts of wood (loosely piled) give about one part of charcoal. Ovens give a slightly higher yield than piles, but the product is inferior, for it is estimated that 10 parts in volume are required to produce the same amount of heat as nine parts of piled charcoal. On the other hand, charring in ovens gives various by-products: methyl alcohol, acetic acid, essence of turpentine, tar, etc. Specially designed small

ovens are used to collect the tar and oil of turpentine produced during the charring of dry pine stumps.

The following data are available with regard to the production of charcoal in 1913:—

Method of Preparation	Amount of charcoal obtained in bushels
Forest wood charred in ovens . . . . .	8 063 000
Wood waste . . { charred in piles . . . . .	29 166 000
{ charred in ovens . . . . .	1 323 000
	<u>38 552 000</u>

There are no exact statistical data on the quantity of charcoal prepared in piles in the forests, but, according to the following calculation it may be estimated at about 75 502 000 bushels.

Total amount of charcoal used by metallurgic works . .	117 355 000 bushels
Deduct: Charcoal imported from Finland and Norway . .	<u>3 301 000</u>
Total amount of charcoal produced in Sweden . . . . .	114 054 000
Deduct: Production of charcoal known from statistics . .	<u>38 552 000</u>
Amount of charcoal prepared in piles in the forests . .	75 502 000

PRODUCTS FROM THE DRY DISTILLATION OF WOOD. — Formerly the preparation of wood tar was an important industry in Sweden as it was one of the principal exports. At the present day this industry is carried out only in the two most northern provinces, and the tar produced is exported chiefly from the town of Umeå. For its manufacture large funnel-shaped utensils, open at the top, are used. The wood is piled up in them and covered with earth; the tar runs out from underneath. Various saw-mills have tar ovens from which are obtained, not only tar, but also the other products of dry distillation: methyl alcohol, acetic acid, acetone, etc.

Table II gives the data concerning the importation and exportation of these various products in 1913.

TABLE II. — *Importation and exportation of the products and by-products of the dry distillation of wood, in 1913.*

Products	Importation		Exportation	
	Quantity (metric tons)	Value	Quantity (metric tons)	Value
		£		£
Tar and its residues . . . . .	336	2 036 11. 6	7 996	52 841 15. 8
Black pitch . . . . .	3 956	21 784 13. 1	139	916 4.10
Resin . . . . .	7 077	108 127 0.11	9	143 2. 5
Resin gum . . . . .	90	2 478 5. 0	802	22 097 12. 0
Oil of turpentine . . . . .	516	16 186 16. 8	228	5 756 17. 2
Methyl alcohol . . . . .	0.7	23 19. 0	401	11 279 5. 4
Acetone . . . . .	62	1 045 15. 6	156	7 739 8. 2

The important place occupied in Swedish imports by that of wood of various kinds has already been pointed out. A comparison of the wood exports of Sweden and other countries is difficult, as are all international statistics on account of the different methods of calculation in use in the various countries. Nevertheless, the data contained in Table III, taken from the official statistics of each country, shows fairly well the place held by each of the principal wood-exporting countries.

TABLE III. — *Wood exports of the principal exporting countries from 1906 to 1913.*

Country	1908	1909	1910	Average annual value from 1906 to 1910	1911	1912	1913
	\$	£	£	£	£	£	£
Sweden . . . . .	11 976 763	11 718 494	14 578 705	12 951 572	15 096 513	16 595 060	18 256 068
Norway. . . . .	1 429 618	4 048 463	4 377 509	4 294 255	4 297 885	4 678 999	4 955 062
Finland . . . . .	5 535 386	5 948 395	6 887 121	6 111 312	7 236 679	5 062 624	—
Russia . . . . .	11 733 914	13 348 467	14 551 935	12 269 442	14 712 254	16 122 168	17 299 897
Austria-Hungary . . .	12 865 871	12 466 260	13 535 578	13 559 130	12 731 600	14 468 912	13 531 852
United States* . . . .	16 746 043	13 940 433	16 188 849	15 636 667	18 952 392	21 863 398	23 970 751
Canada* . . . . .	9 173 434	10 994 502	10 682 902	10 270 158	9 634 111	10 192 763	10 268 632

\* In these two countries the commercial years do not coincide with the solar years.

The high figures of the United States timber exports may probably be explained partly by the fact that they also include valuable wood (oak and other deciduous trees).

The exporting countries have only been compared with regard to the *value* of their exports, as it is not possible to make an exact comparison of the *amount of wood* exported. All that can be said on this point is that, in Europe, the first place has been held alternately by Russia (without Finland) and Austria-Hungary, then during the last two or three years, by Sweden.



SECOND PART.  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1 -- *International Yearbook of Agricultural Legislation, 7th. Year (1916).* — INTERNATIONAL INSTITUTE OF AGRICULTURE, Rome 1917.

LEGISLATIVE  
AND ADMINIS-  
TRATIVE  
MEASURES

The seventh volume of the *International Yearbook of Agricultural Legislation* has just been published by the International Institute of Agriculture. It contains, systematically classified, all the laws relating to agriculture in the various countries. This publication is, therefore, of great interest under the present war conditions.

The *Yearbook* is divided into 11 parts : — The first (Statistics), second (Commerce), fourth (Industries depending on plant products), and fifth (Industries depending on animal products) are of the greatest interest to those who wish to follow, in all its details, the legislative movement with regard to foodstuffs brought about by the European crisis. In these divisions of the *Yearbook* is included everything bearing on : Statistics of stocks and crops ; trade in cereals and supplies in general ; trade in other vegetable foodstuffs ; seed trade ; fertiliser trade ; trade in oil-yielding fruits ; trade in textile plants and tobacco ; trade in live stock and animal products ; trade in agricultural machinery ; facilities granted for imports and restrictions laid on exports ; measures for forestalling and dealing with the rise in prices ; dishonest competition and fraud in trade ; legal measures for regulating commercial contracts ; measures for preventing the advance sale of crops ; transport of vegetable and animal products ; regulation of industries concerning plant products and chemical fertilisers ; regulation of crops during the war.

The 7th. part, devoted to plant diseases, weeds and animals injurious to agriculture, gives the text of the Egyptian laws concerning : the protection of plants against diseases from abroad, diseases of fruit trees, the de-

struction of the cotton bollworm, orange pest (*Aspidiotus aonidium*), the text of the Soudan order concerning the destruction of locusts. It also includes : the orders of the French Government with regard to the sale and use in agriculture of arsenical compounds ; an Australian (Victoria) law concerning the sale of anti-cryptogamic products and insecticides ; the order for carrying out the Italian law of June 26th., 1913, No. 881, on plant diseases ; the various Italian decrees for the control of field mice.

The *Yearbook* contains many provisions with regard to agricultural co-operation, insurance and credit.

The part devoted to rural property includes the strictly legal measures defining and regulating the rights of property, and the charges on real estate held either in usufruct or by way of security ; the provisions to be observed in the transmission of these rights and in the determination of the title to ownership, especially in the interest of third parties ; the method of procedure with regard to attachments on movable goods and real estate. It also contains the provisions of a more specially social and political nature, which tend to act directly on the distribution of real estate and to allow a more complete use being made of the land.

With regard to the less important measures the *Yearbook* only gives the original title together with the French translation ; for the others, either extracts from the text or else the whole text is given. There is an analytical introduction of 77 pages published in five languages, French, English, Italian, Spanish and German, which gives a summary of the whole volume (1250 pages). There is also a chronological index of the countries and an alphabetical subject index.

#### RURAL HYGIENE

2 - **A Biological Analysis of Pellagra-Producing Diets: I) The Dietary Properties of Mixtures of Maize Kernel and Beans.** — MC COLLUM, E. V. and SIMMONDS, N., in the *Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 29-61, 24 charts. Baltimore, Md., October, 1917.

The first phase of the studies on nutrition undertaken by the authors and their collaborators at the Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison (1), dealt with the cause of nutritive failure in animals restricted to diets of proteins, carbohydrates, fats and inorganic salts, all the foods being chemically pure. After a careful consideration of the work of HOPKINS, STEPP, and FUNK, the authors came to the conclusion that these mixtures were lacking in two substances, or groups of substances, indispensable to the preservation of animal life.

(1) HART, E. B., MC COLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., *Wisconsin Agricultural Experiment Station, Research Bulletin* 17, 1911 ; HART and MC COLLUM, *Journal of Biological Chemistry*, 1914, Vol. XIX, p. 373 ; MC COLLUM and DAVIS, *Ibid.*, 1915, Vol. XX, p. 415, Vol. XXIII, pp. 181 and 231 ; MC COLLUM, SIMMONDS and PITZ, *American Journal of Physiology*, 1916, Vol. XII, pp. 333 and 361 ; MC COLLUM and KENNEDY, *Journal of Biological Chemistry*, 1916, Vol. XXIV, p. 491 ; MC COLLUM, SIMMONDS and PITZ, *Ibid.*, 1916, Vol. XXV, p. 105 ; HART, MILLER and MC COLLUM, *Ibid.*, 1916, Vol. XXV, p. 239 ; MC COLLUM, SIMMONDS and PITZ, *Ibid.*, 1916-1917, Vol. XXVII, pp. 153 and 211 ; MC COLLUM, *Journal of the American Medical Association*, 1917, Vol. LXVIII, p. 1379 ; MC COLLUM, SIMMONDS and PITZ, *Journal of Biological Chemistry*, 1917, Vol. XXIX, pp. 341 and 521 ; Vol. XXX, p. 13 ; MC COLLUM and PITZ, *Ibid.*, 1917, Vol. XXXI, p. 229. (Ed.)

One of these (fat-soluble A), is soluble in fats, and found in its most concentrated form in butter fat and egg yolk fats. The second substance is never associated with fats in foods, but is always present in natural foods in relative abundance. It is easily administered in experimental rations by the addition of alcoholic extracts of natural foods, but it is also soluble in water. This is called by the authors water-soluble B.

The authors showed phosphorised proteins to have no superior value to those containing no phosphorus and it is now known that a long list of substances (including complex lipoids, pigments, sulphatides of the nerve tissues, components of the various prosthetic groups) with which the body proteins are combined, are produced within the tissues and do not need to be supplied with the food. The synthetic capacity of the animal cells has thus been shown to be immeasurably greater than had been supposed, but all the evidence still points to the fact that nearly all the amino-acids formed during the digestion of proteins are indispensable components of the diet. Moreover, the animal tissues are very dependent upon certain of the finer stereochemical structures in both the amino-acid and carbohydrate groups which serve them as food complexes.

The second part of the studies was an examination, one by one, of several typical representatives of the classes of natural food substances, such as the seeds, leaves, fruits and tubers of plants. The exact nature of the additions of the factors A and B necessary to complete one of these food substances from the nutrition standpoint was shown. Some of these studies are still in progress.

The results show that serious errors may be made in the choice of foods, especially by the poor. Beri-beri, scurvy, rickets and pellagra, have all been proved to be due to defective diet, although different opinions still prevail as to the etiology of the last disease. FUNK attributed each of the above-mentioned syndromes to the absence of a specific chemical substance which he called "vitamine". The work of the authors and their collaborators on the nature of the dietary deficiencies of any natural food-stuffs has lead them to conclude that, under the present existing conditions, there are three other dietary factors causing malnutrition in both man and animals.

The third part of the studies, described in the present papers, consisted in a close experimental enquiry into the properties, with regard to the several dietary factors, of the diets usual in human nutrition and derived from all the more important food materials (except milk and eggs) in common use in the United States. Eggs, and more particularly milk, are a wonderful safeguard in human nutrition, and a valuable addition to all rations used in animal production.

In a previous paper were discussed the points of resemblance in the dietary properties of seeds in general as contrasted with those of the leaf of the plant. The most important generalisations which can be made concerning the seeds as a group are the following:—

1) None of the seeds studied, when forming the sole source of nutriment, can produce growth or prolonged well-being in a young animal. Mixtures of seeds are more satisfactory

for keeping animals in a good state of health, without growth, than seeds of a single species as a sole food; mixtures of seeds fed with distilled water (salt-free) will not support growth in young rats.

2) The inorganic content of each of the seeds studied (wheat, oat, maize, rice, wheat germ, bean, pea, flax and millet) is so constituted with respect to the total quantity and relative quantities of its constituents that certain salt additions are essential before growth can proceed in young animals. This applies both to mixtures of seeds and to seeds of a single variety.

3) The seeds of wheat, oat, maize, rice, bean and pea are too low in their content of a dietary essential, the nature of which is still unknown, to supply the needs of a young animal during growth. This substance is present in abundance in certain fats, such as butter and egg yolk fats, and the fats extracted by solvents from animal organs, such as the liver and kidney, free from visible fats. It is also found in abundance in the leaves of plants and in considerable quantities in the seeds of flax and millet. The authors have provisionally called this dietary essential "fat-soluble A". It is not extracted from plants with the fats by solvents such as ether, chloroform, benzene or acetone, and is, therefore, not found in any fats or oils of plant origin. Hot alcohol does not remove it from plant tissues.

4) All the seeds studied contain protein mixtures of a relatively poor quantity when the proteins of a single kind of seed serve as the sole source of proteins.

5) Each of the seeds studied can be supplemented by highly purified protein, pure inorganic salts, and one of the growth promoting fats, so as to form a satisfactory ration for growth and maintenance. 15 to 20 % of any one of the seeds mentioned, when fed with a mixture of purified food substances, will serve to supply all unidentified dietary factors soluble in water or alcohol. So far there is evidence of only one such indispensable substance — water soluble B — which is never associated with fats of either animal or plant origin.

6) Generalising from studies of three types, clover, alfalfa and cabbage, the leaf differs from the seed in having a high content of inorganic elements, and is particularly rich in those elements, calcium, sodium and chlorine, which are found in but small amounts in the seed. The leaf is much richer in the fat-soluble A than are such seeds as wheat, oat, maize, bean and pea. Leaf and seed supplement each other with respect to these two dietary factors. Since, in many cases at least, the leaf and seed mixtures have been shown to yield adequate protein mixtures, there is probably always some supplementary relationship between them with respect to the amounts of the various amino-acids which they yield on digestion.

In the studies quoted no systematic data were given showing the dietary properties of mixtures of cereal and legume seeds. The present paper describes the nature of the purified food additions which must be made to combinations of the maize kernel and the white (navy) bean in various proportions in order to make these seed mixtures dietetically complete. The experiments described aimed at making clear the value of each dietary factor in the maize bean mixtures as compared with several of the most important seeds, especially maize, wheat and navy bean. These last were thoroughly studied separately so as to show the nature of their dietary deficiencies.

The results, obtained with rats, are given in a set of charts and summarised as follows: —

1) The two seeds mixed, as when separate, contain too small an amount of fat-soluble A to induce optimum well-being in growing animals.

2) The mixtures of maize and beans furnish a great abundance of the second unidentified dietary factor, water soluble B.

3) The most satisfactory protein mixture obtainable with these two seeds consists in about 80 % of maize and 20 % of bean. This protein mixture has a slightly higher biological value than an equivalent amount of maize kernel proteins. In smaller quantities (e. g. 7 % of the food mixture) the proteins of the wheat and the maize kernel have about the same value. When a ration is properly constituted with regard to other factors and contains 9 % of wheat proteins, growth may be practically normal over a period of 5 months, after which an injurious effect is apparent in stunting and lack of fertility. It is highly probable that if the maize protein content were raised to 12 %, approximately normal growth would result. Better results are obtained by adding pure casein to a ration composed of a mixture of 12 % of maize (63 % of the mixture) and beans (37 % of the mixture).

In a previous paper the authors showed that 6 % of milk proteins in a food mixture just suffice to support normal growth in rats. The protein mixture from 80 % maize and 20 % beans has, therefore, just about one-half the biological value for growth that the total protein mixture in milk possesses.

4) A detailed study was made of the exact nature of the mineral deficiencies of the maize and bean mixtures. The results confirm others previously obtained in which sodium and calcium were shown to be the elements determining the unsatisfactory character of the mineral content of seeds in general. This is of great importance in human nutrition and agricultural practice in districts where the drinking water is nearly free from lime and sodium chloride. Efficient utilisation of food by growing animals is not possible when the diet is deficient in these elements.

As regards human nutrition in districts where the water is low in calcium and sodium the ration may be completed by milk or leaves of plants. The use of leaves in almost strictly vegetarian diets maintains life, as they supply the mineral deficiencies and the shortage of the fat-soluble A in the seeds.

The investigations carried out by the authors by special methods, show how near the danger line is the faulty diet of some classes of people, even in the United States. GOLDBERGER (*Journal of the American Medical Association*, 1916, Vol. LXVI, p. 471) obtained experimental pellagra with a diet typical of that eaten by pellagrins — wheat flour (patent), corn meal, corn grits, corn starch, white polished rice, standard granulated sugar, cane sugar, sweet potatoes, pork fat (fried out of salt pork), cabbage, collards, turnip greens and coffee. Calculated on a wet basis, the sweet potatoes, cabbage and collards made  $\frac{1}{6}$  th. of the diet, but, on a dry basis, only 4 % of the total solids. This quantity is insufficient to make good the serious shortage of calcium and sodium in the remainder of the diet. Sodium is supplied by the salt added, but there is still a deficiency of calcium. The work of the authors shows that there is far from an adequate quantity of the fat-soluble A in GOLDBERGER's diet, the protein content of which was not above 8 % of the food mixture. In an experiment carried out by the authors a diet containing 12.5 % of protein, supplied by 63 % of maize kernel and 37 % of beans, was insufficient for rats. As the animals developed normally immediately casein was added to their diet, the deficiency of the diet can only be attributed to shortage of proteins. In the light of such experimental evidence it is entirely unnecessary to attribute the cause of pellagra to the absence of a hypothetical "vitamine".

3 - War Bread (Unsalted Lime Bread). — DUBOIS, RAPHAEL, in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 17, pp. 818-821, Paris, November, 1917

The French nation eats bread containing from 15 to 20 grms. of salt per kg. In Paris the proportion is sometimes as high as 22, and even 25 grms. Those eating 1 kg. of bread, therefore, consume an average of 20 grms. of salt in the bread alone. The amount of salt mixed with other foods may, on an average, be placed at 10 grms. Finally, according to GAUDIN (*Cours de Minéralogie*, 1st. Series, 2nd. Ed., pp. 65-66) the amount of salt contained *naturally* in the food eaten is not less than 20 grms. a day.

These facts show that, on an average, an adult person consumes 50 grms. of salt daily. The figure seems excessive, since the amount of salt excreted daily, without decomposition, is estimated at from 18 to 20 grms. only. This would mean that 30 grms. of salt remain to supply the hydrochloric acid of the gastric juice, which seems hardly admissible, even for hyperhydrochloric subjects. It is true that vegetarians require a larger quantity of salt, since, according to BUNGE, it helps to remove the potassium, contained in large quantities in vegetables, but, in proportion to people living on a mixed diet, there is but a small number of vegetarians.

An excess of salt in seasoning causes the assimilation of the food to be destroyed to too great an extent, and this can only be compensated for by an increased consumption. The author's experiments show that the amount of unsalted bread eaten is less by one quarter than that of salted bread. The same would probably apply to other foodstuffs, a very important fact from an economic point of view. Moreover, an excessive consumption of solid foods is accompanied by an excessive consumption of liquids, and, among those using alcoholic drinks, the salt becomes accessory to the alcohol.

In view of the great benefit derived in therapeutics by the *elimination of chlorides* in many cases of arthritis, it is probable that the *preventative* partial elimination of chlorides by the use of unsalted bread would be advantageous.

There is no danger that the insipid taste of unsalted bread would prevent its being eaten by the public. In certain countries, for example in some of the districts of Italy, Tuscany in particular, salt is not added to the bread. Many people prefer it to salted bread; others soon get accustomed to it.

The author recommends a bread which he calls *unsalted lime bread*, because, to every kg. of bread, are added from 15 to 20 grms. of calcium carbonate, which, unlike lime water, does not "kill the yeast" by preventing the dough from rising. Washed chalk or precipitated calcium carbonate answer the purpose equally well, but the author prefers prepared chalk. The chalk is mixed with water, and with it is made the dough, which gains in whiteness, rises perfectly, is never acid, and has a very appetising smell. The excess of calcium carbonate has no ill effects, as the author proved by eating large quantities of it.

The author does not believe the idea of adding chalk to bread to be new, but has been unable to find any published reference to it.

- 1 - **The Nutritive Value of the Soy Bean.** - DANIELS, AMY, L. and NICHOLLS, NELL, B., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 91-102, 6 diagrams. Baltimore, October, 1917.

This paper gives an account of work carried out at the Department of Home Economics, University of Wisconsin, Madison. In order to determine the nutritive efficiency of a given food, it is necessary to make biological tests, as well as chemical determinations, for chemical analysis does not determine the optimum amounts of the various amino-acids necessary to physiological well-being nor the chemical nature of the food accessories.

In the biological experiment made by the writers, the soy bean was fed to rats. In a preliminary investigation, it was found that when these animals were given exclusively soy beans, they failed to grow. When, however, the rats were placed on a ration consisting of: soy beans (60 per cent.), lard (16 per cent.), maize starch (18.7 per cent.) and a salt mixture (6.3 per cent.), containing calcium, chlorine and sodium, the animals grew and reproduced, but the adult rats were under-sized, and the younger were not only smaller at birth, but the litters were also smaller. The addition of the salt mixture, therefore, did not produce a perfect food. The fact that 2 generations of rats were reared on this ration, shows that the soy bean must contain an abundance of MAC COLLUMS'S "fat-soluble A" which, on the contrary, is only present in small quantities in certain cereal seeds. This was also confirmed by the difference in the development of several rats fed upon a diet of purified food substances (freed from fat-soluble A) and the growth of four animals of the same litter which were fed a ration of 50 per cent. soy bean without any addition of fat. In this connection, it is interesting to note that Mac Collum found that the extracted oil of soy bean was quite free from "fat-soluble A".

Young animals produced and suckled by mothers having a liberal supply of "fat-soluble A" were able to withstand a shortage of this material during their most rapidly-growing period much better than those animals whose mothers received considerably less. A plausible explanation for this marked difference in the behaviour of the 2 groups seems to be, that a diet suitable for the maintenance of adult animals, and for reproduction, does not contain a sufficient amount of fat-soluble A to insure the growth of young animals. The writers conclude from these 2 facts: 1) animals can accumulate a reserve of fat-soluble A; 2) young animals require a greater amount of this substance than adult ones.

In all the experiments, the value of the protein of the soy bean has been demonstrated, and it appears to be quite equal to that of the casein of milk. These findings are somewhat surprising in view of the fact that the protein of other legumes (peas and white beans) has been found insufficient.

A diet lacking "water-soluble B" retards growth and produces abnormal physiological conditions such as beri-beri and polyneuritis.

In the dietary used in these experiments by the writers the soy bean was the only possible source of "water soluble B". Since none of the rats in this investigation presented any of these symptoms, it is logical to conclude that soy beans are rich in this water-soluble substance.

An economic consideration of the soy bean leads us to conclude that it is one of the most valuable of leguminous seeds for human consumption, for it contains a high percentage (36.5 per cent.) of physiologically good protein, a considerable amount of energy-yielding material in the form of fat (17.5 per cent.) and carbohydrate (12 per cent. digestible), and a large amount of "water soluble A" and "water-soluble B", which substances promote growth.

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK.

5 - Recent Investigations and Observations Made at the Imperial Institute (London) (1). — *Bulletin of the Imperial Institute*, Vol. XV, No. 1, pp. 1-46; 78-82; 107-113. London, January-March, 1917.

THE PRODUCTION OF WHEAT AND OTHER CEREALS IN EGYPT. — More than  $\frac{4}{5}$  of the total area cultivated in Egypt (in round numbers 5 350 000 *jeddans*, or Egyptian acres = 5 553 300 English acres), is capable of growing wheat, but so long as cotton remains as remunerative a crop as it is at present, there is very little chance of an increase in the area at present assigned to wheat.

Indeed with the abnormally high prices which now rule for cotton, it is probable that the area occupied by that crop will exceed the percentage of 32.5, which has been the proportion of the cultivated land occupied by it during the last few years. The restriction of the cotton areas during 1915 and 1916 allowed a slight increase in the area sown in wheat and a few other cereal crops, but the increase must be looked upon as abnormal, and the extent usually given to that crop may be considered to be 1 300 000 *feddans* (1 349 400 acres) Taking the cultivated land roughly at 5 350 000 *feddans* (5 553 300 acres), this represents 24.3 per cent of the whole.

The most important cereals grown in Egypt in addition to wheat are maize, rice and millet (barley occupies 7-8 per cent. of the cultivated area, but it is almost entirely used for cattle food). As is shown by Table I, the country is unable to grow sufficient cereals for its own consumption (including the amount required for seed) in normal years. No new lands are likely to become available for wheat planting in the near future, but much remains to be done in improving the wheat strains, the methods of marketing, and the system of cultivation.

TABLE I. — *Production and Consumption (in metric tons) of Wheat, Maize, Rice and Millet in Egypt During the Period 1910-1915.*

	1910-1911	1911-1912	1912-1913	1913-1914	1914-1915
Production . .	2 944 509	2 886 900	2 929 513	2 891 115	3 060 819
Consumption .	3 128 561	3 096 226	3 231 948	3 030 572	3 639 371
<i>Difference</i> .	— 183 971	— 209 326	— 302 435	— 139 547	+ 27 475

(1) See also, B. 1915, No. 5: R. 1917, No. 118. (Ed.)



Wheat is grown in Egypt entirely as a winter crop. Owing to the wheat harvest taking place in April-May, it cannot advantageously be followed by cotton; therefore the wheat land is left fallow until July-August, when maize may be planted, or until October or November, and then bersim (*Trifolium alexandrinum*) is sown.

FLAX-GROWING IN EGYPT. — In *Bulletin* No. 12, *Technical and Scientific Service, Ministry of Agriculture, Egypt*, an account is given of an experiment in flax-growing which has been conducted at the Government Farm at Guemmeiza with the object of determining the amount of seed which yields the best results with reference to both seed and fibre. The best fibre and the largest yield were obtained from the most thickly sown plots, but the amount of seed secured was smaller than in the less thickly sown plots. On some of the plots, the stalks were gathered before the seed had been completely formed, so as to obtain the best possible fibre, whilst sacrificing the seed-crop. Other plots were harvested at a later date, in order to obtain both fibre and seed, and a third series were left still longer with the object of obtaining a good crop of seed. The seed obtained from the 2<sup>nd</sup> and 3<sup>rd</sup> series of plots was found to contain approximately the same percentage of oil; this is in harmony with the results obtained in England by EYRE and FISHER (*Bulletin of the Imperial Institute*, 1916, Vol. XIV, p. 115). The supposition that good flax can only be obtained by harvesting the crop before the seed is ripe, was not supported by the results of this trial; the best return for the fibre crop per feddan was secured in the latest harvest.

A sample of flax straw produced in the course of these experiments was sent for examination to the Imperial Institute in 1917. It consisted of retted flax stems from 26 to 30 in. in length and from  $\frac{1}{16}$  to  $\frac{1}{8}$  in. in diameter; it yielded about 25 per cent. of soft, fairly lustrous fibre usually about 24 in. long; the strength was irregular. The extracted fibre was valued at £ 200 per ton in London in January 1917; in normal times it would be worth about £ 60 per ton.

COTTON CULTIVATION IN AUSTRALIA (1). — The climatic conditions of large areas in the warmer parts of Australia are well adapted for the growth of cotton. At the present time, however, it is cultivated to only a small extent in Queensland and the Northern Territory. The chief difficulty is the high cost of picking, as so far, no satisfactory cotton-picking machine has been found. It is thought that the labour difficulty might be overcome by growing the crop in small areas only, which could be picked by the family of the cultivator. The British Cotton Growing Association and the Government encourage the industry by different means, by: making a grant, providing seed for experiment and guaranteeing a minimum price, etc. Samples of cotton grown in Queensland, Western Australia and New South Wales have been received at the Imperial Institute in recent years. Their quality varied from mediocre to good; the samples from New South Wales were on the whole the most promising.

(1) See *B.* 1911, No. 2578. (*Ed.*)

FIBRES FROM VARIOUS SOURCES. — Description of a number of fibres examined in recent years at the Imperial Institute. Table II gives the composition and the value of these fibres.

TABLE II. — *Composition and Value of Fibres from various Sources.*

Fibre	Source	Analysis						Estimate per metric ton
		Moisture %	Ash %	A - Hydrolysis loss %	B - Hydrolysis loss %	Acid purification loss %	Loss on washing in water %	
<i>Hibiscus cannabinus</i> .	Egypt	11.1	2.7	4.4	7.6	4.6	1) 2.0	76.8 £ 30
<i>H. cannabinus</i> . . .	Rhodesia	9.4	1.3	17.3	18.3	4.9	2.6	71.2 £ 27
<i>H. cannabinus</i> . . .	Nyasaland	10.8	3.2	17.9	21.7	8.0	3.6	71.6 £ 37
<i>Sida rhombifolia</i> . .	Swaziland	11.6	2.3	13.2	19.6	5.9	4.6	70.5 £ 17 — £ 18
<i>Agave sisalana</i> . . .	Rhodesia	7.4	0.6	9.3	11.7	1.1	1.3	80.5 £ 65
<i>Furcraea gigantea</i> . .	Rhodesia	10.1	1.6	14.8	17.8	4.4	—	72.0 £ 24 — £ 35
<i>F. gigantea</i> . . . .	S. Africa	9.9	1.3	13.8	16.3	2.8	—	72.7 £ 20 — £ 21
<i>Asclepias fruticosa</i> (fibre of stems) . .	S. Africa	8.0	1.5	13.1	16.2	7.0	—	82.0 £ 32 — £ 38
<i>A. fruticosa</i> (floss) .	S. Africa	—	—	—	—	—	—	£ 25 — £ 30
Kapok . . . . .	Sudan	—	—	—	—	—	—	—
Kapok . . . . .	Togoland	—	—	—	—	—	—	—
Nettle fibre (freed from gum) . . . .	Bengal	—	—	—	—	—	—	£ 26 — £ 30

1) The water contained 0.75 % of alkali expressed as sodium carbonate.

A sample of the seed hairs of *Ipomœa albivenia* were also examined. Large quantities of this material can be collected in Natal and Zululand, where it is known as Kaffir, or Natal, cotton. It is, however, not a very promising material, for the fibres are weak, and therefore difficult to spin or card. It is much less resilient than kapok, and therefore not so useful for stuffing upholstery. These seed-hairs might be used in the production of nitro-cellulose, but they contain much less cellulose than cotton (77.3 as against 95 to 96.5 per cent.). The raw fibre would not be sufficiently absorbent for use in surgical swabs, though it is more absorbent than untreated cotton.

NEW PAPER-MAKING MATERIALS. — The following substances were recently investigated at the Imperial Institute as sources of pulp for paper-making: — cladodes of *Ecdiocolea monostachya* (fam. *Restiaceae*) from Western Australia; the wood of *Neoboutonia macrocalyx* (*Euphorbiaceae*) from the East Africa Protectorate; the bark of *Brachystegia Randii* (*Leguminosae*) from Rhodesia. The analyses of the substances are set forth in Table III. The first is of about the same value as Algerian esparto grass, the yield of pulp from the air-dry material being 44 per cent.; the second has good qualities and supplies from 46 to 50 per cent. according to treatment; the third yields from 32 to 35 per cent. of good pulp. It seems likely

that fibre of value for textile or cordage purposes could be prepared from *Brachystegia Randii* bark.

TABLE III. — *Analyses of Paper-making materials.*

	Moisture	Ash in dry material	Cellulose in dry material	Resin	Length of ultimate fibres
<i>Ecdiocollea monostachya</i> . . . . .	10.1 %	3.01 %	49.5 %	—	2.00 — 5.40 mm
<i>Neoboutonia macrocalyx</i> . . . . .	10.5	1.9	61.0	3.5 %	1.02 — 1.27
<i>Brachystegia Randii</i> . . . . .	11.8	3.4	43.0	—	1.27 — 2.54

SOME NEW OIL SEEDS FROM AMERICAN PALMS. — The oil seeds dealt with are: — the kernel of babassu and bassoba (*Attalea* sp., possibly *A. funifera*); tucan, or tucum, or large Panama nuts (*Astrocaryum* sp.); Paraguay kernels (*Acrocomia* sp.), which only differ from *A. sclerocarpa* in their smaller size. They contain respectively 4.2 - 6.5 - 6.0 per cent. of moisture, and yield 70.2 - 52.0 - 69.4 per cent. of fat in proportion to the dry matter.

The chemical characters of the oils and the composition of the palm kernel meal are given in Tables IV and V. These kernels seem to be a valuable addition to the oil seeds now utilised as sources of fat in the edible fat industry. The cakes made from them have a feeding value about equal to that of coco-nut cake.

TABLE IV. — *Chemical Characters of the Oils from American Palms.*

	Babassu kernels	Tucan kernels	Paraguay kernels
Melting point (in open tube) . . . . .	26 °C	30.5°C.	—
Solidifying point of fatty acids . . . . .	23 °C	27 °C.	21 °C.
Specific gravity at $\frac{100^{\circ}\text{C}}{15^{\circ}\text{C}}$ . . . . .	0.868	0.867	0.865
Acid value . . . . .	5.5	2.9	26.1
Saponification value. . . . .	249	249	247
Iodine value % (Hübl. 17 hours) . . . . .	15.6	11.6	28.5
Unsaponifiable matter % . . . . .	0.3 %	0.3 %	0.3 %
Volatile acids, soluble. . . . .	5.8	3.8	6.5
"    "    insoluble . . . . .	10.2	5.9	10.2

NUTS OF *Ricinodendron Rautaneii* (MANKETTI NUTS) FROM SOUTH-WEST AFRICA. — These nuts are the product of a euphorbiaceous tree growing in the South African veldt, and especially plentifully in the region between Tsumeb and the Okavango River. It forms vast forests near the Omaramba River. The kernels of the nuts are oily and are eaten by

TABLE V. — *Composition of Residual Meals.*  
(Calculated to Contain 7 per cent. of fat).

	Babassu kernel meal	Tucan kernel meal	Paraguay kernel meal
	per cent	per cent	per cent
Moisture . . . . .	8.5	8.4	8.7
Crude proteins . . . . .	23.2	10.0	31.6
consisting of:			
True proteins	22.0	10.0	31.4
Other nitrogenous substances	1.2	nil	0.2
Fat . . . . .	7.0	7.0	7.0
Carbohydrates . . . . .	45.9	62.9	35.5
Fibre . . . . .	10.6	9.5	11.7
Ash . . . . .	4.8	2.2	5.5
Nutrient ratio . . . . .	1:2.7	1:7.9	1:1.6
Food units . . . . .	121.4	105.4	132.0

the natives. The average weight of the fruit (drupe) is: entire fruit 7.6 gm., the nut, 5.0 gm. and the kernel 0.7 gm. The kernels contained 4.1 per cent. of moisture and yielded 57.2 per cent. of bright yellow liquid oil, equivalent to a yield of 59.6 per cent. from the dry kernels. This oil had the following characters: specific gravity at 55° C., 0.928; acid value, 1.9; saponification value, 191.5; iodine value 133.6 per cent. (it is therefore a semi-drying oil). It appears that this oil can be used for food. It is, however, very difficult to extract the kernels, owing to the softness of the latter, and the extreme hardness of the shells.

The pulpy mesocarp should have a moderate nutrient value, but trials would be necessary before it could be definitely recommended as a cattle feed. Its percentage composition is as follows: moisture 16.6; crude protein, 7.9, (of which 6.5 is true protein and 1.4 other nitrogenous substances); fat, 1.62; carbohydrates, etc. (by difference), 65.4; cellulose, 3.0; ash, 5.5; nutrient ratio 1:8.6; food units, 89.

THE PRODUCTION OF SANDALWOOD OIL IN MYSORE, BRITISH INDIA. — The source of true sandalwood oil is the heartwood of the trunk and larger roots of *Santalum album* Linn., a small evergreen tree native of South India, more particularly of Coorg and Mysore. It is estimated that about  $\frac{7}{10}$  of the world's supply of sandalwood is derived from Mysore, in which State it is a Government monopoly, the extraction and exploitation of the wood being entrusted to the Forest Department. Before the war, about 52 per cent. of the sandalwood oil exported from India was sent to Germany for distillation; about 18 per cent. to the United States, and from 10 to 20 per cent. to the United Kingdom. The value of the total export of sandalwood from India in 1913-1914 was £128 626. In the two years that preceded the outbreak of war, the price of sandalwood oil in Mysore had doubled, the Government having restricted the amount offered for sale to about 2 500 tons, the estimated amount of the world's annual consumption. This restriction of output was to some extent justified in view of the ravages of a

disease called the "spike", which in recent years has caused the destruction of a large number of trees. The spike disease first appeared in 1900; the method adopted for its control consists in uprooting affected trees and is said to have checked its spread.

On the outbreak of war, the Government started the distillation of sandalwood oil in Mysore for export to Europe. The first factory was erected near the Institute of Science, at Bangalore; it is now producing 5000 lb. a month. A second factory is now being erected in Mysore; it will ultimately have an output of about 20 000 lb. of oil per month, which will probably be sufficient to supply the whole of the European demand for this product. There is considerable demand for sandalwood in Eastern countries, where it is employed for perfumery and ceremonial uses, and also for carving.

Owing to the high price of true sandalwood oil, several substitutes have been placed on the market; of these the chief is the oil obtained from *Amyris balsamifera*, a Rutaceous plant native of Venezuela, and known commonly as West Indian sandalwood. The so-called sandalwood exported from Australia is mainly derived from *Fusanus spicatus*; in addition there is a small export of the South Australian sandalwood, *F. acuminatus*, or "quandong", which goes principally to China and India.

*Santalum album* is grown in Celebes (Dutch East Indies); it is said to be grown in Java, and has also been successfully cultivated in Mauritius. The tree is semi-parasitic; in India some 144 different trees have been recorded as serving as hosts, of which 26 are leguminous species. As *S. album* is of slow growth, it requires to stand from 20 to 40 years in order to develop the maximum amount of fragrant wood, therefore it is necessary to select as hosts, species of trees that have a life of at least 40 years. Probably trees of the leguminous family would be most suitable for the purpose, such trees as *Pongamia glabra* Vent., and *Albizzia Lebbeck* Benth. commonly serving as hosts in India. In the matter of soil, *Santalum alba* does not appear to be very exacting, but the highest yields of oil have been obtained from wood grown on poor rocky soils.

**SOUTH AFRICAN GUM.** — A sample of typical South African gum (probably derived from the "white thorn" *Acacia horrida*) had the following composition: moisture, 14.5 per cent.; Ash, 2.9 per cent.; matter insoluble in water, 2.0 per cent.; Acid number, 3.9; relative viscosity of a 10 per cent. solution at 22° C., 8.0. This sample yielded a mucilage possessing good adhesive properties.

**BURMESE BLACK VARNISH OR LACQUER.** — This is a natural varnish obtained by making incisions in the bark of the "black varnish tree" (*Melanorrhoea usitata*), one of the *Anacardiaceae*, which occurs in various parts of Burma, in Manipur and Siam. In 1914-1915, the different Forest Circles of Burma produced 3 390 cwts, of which the value was £ 1 138. A sample examined at the Imperial Institute contained: moisture, 5.3 per cent.; ash, 0.2 per cent.; matter insoluble in benzene, 2.6 per cent. It was found that the varnish required about 3 days to harden in an atmosphere saturated at a temperature of 30-35° C. The length of time that this

varnish takes to dry is a obstacle to its employment. Further, it is very similar to Chinese and Japanese varnish; the latter is derived from *Rhus vernicifera*.

**CHICORY SUBSTITUTE FROM SOUTH AFRICA.** — The inhabitants of certain parts of South Africa, notably the Waterberg and Zoutpansberg districts of the Transvaal, utilise the dried roots of the "witgatboon" (*Caparis albitrunca*) as a substitute for chicory. A firm of chicory manufacturers in London who were commissioned by the Imperial Institute to examine this product, stated that it was a very good substitute for chicory. In February 1917, the price of the root in South Africa was stated to be 20s. per 100 lb.

**TOBACCO FROM NORTHERN PROVINCES, NIGERIA.** — Tobacco is grown for native use in almost every part of the Northern Provinces, Nigeria. The crop is carefully cultivated and manured, but the method of curing it is primitive and the product quite unfit for export. In 1915, experiments were inaugurated by the Agricultural Department with the object of producing a "bright" tobacco of the Virginian type. Trials were started at Mairana and Ilorin Experiment Stations. The extreme dryness of the air at the former Station made it difficult to handle the crop successfully, but at Ilorin the results were distinctly promising. Four samples of tobacco produced at Ilorin (3 American varieties, Boyd, Yellow Prior, and Sterling, and one indigenous variety, Native) were examined in 1916 at the Imperial Institute, and found to be of good quality. The excess of nitrogen and nicotine which they contained is no doubt due to the recent and abundant use of nitrogenous fertilisers.

The results of chemical examination expressed on the material conditioned to contain 12 per cent. of moisture are shown in Table VI.

TABLE VI. — *Analyses and Valuation of Tobacco Grown at the Ilorin Experiment Station, Nigeria.*

	Boyd	Native	Yellow Prior	Sterling
<i>Analysis of tobacco:</i>				
Moisture . . . . .	12.0 %	12.0 %	12.0 %	12.0 %
Nicotine . . . . .	4.2	3.9	4.1	4.4
Nitrogen . . . . .	2.9	2.3	3.5	2.7
Ash . . . . .	17.5	15.0	17.6	14.5
<i>Analysis of Ash:</i>				
Lime (CaO) . . . . .	28.9 %	29.8 %	31.5 %	32.4 %
Magnesia (MgO) . . . . .	6.9	7.5	6.4	7.7
Potash (K <sub>2</sub> O) . . . . .	17.4	17.9	17.1	17.7
Soda (Na <sub>2</sub> O) . . . . .	2.1	1.9	1.9	1.4
Sulphates expressed as sulphuric acid (SO <sub>3</sub> ) . . . . .	1.3	1.1	1.5	1.4
Chlorides expressed as Chlorine (Cl) . . . . .	0.9	2.4	1.7	1.0
Value of samples per lb. . . . .	8 d. to 9 d.	6 d to 6 ½ d.	8 d. to 9 d.	7 d. to 7 ½ d.

## CROPS AND CULTIVATION.

6 - On the Origin of "Terra Rossa" (Red Soil) in Italy (1). — GORTANI, M., in *Mondo sotterraneo*, Year IX, No. 6, pp. 125-131; summarised by TISSI, E. in the *Bollettino del R. Comitato Geologico d'Italia*, Vol. XLVI, Part 2-3, pp. 50-52. Rome, 1917.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY.

The discussion on the origin of "terra rossa" is considered chronologically in the above communication. Formerly considered as a product of muddy eruptions, terra rossa had ended by being considered as the insoluble ferruginous clay residue from the dissolution of calcareous rocks due to atmospheric agencies.

The difficulty of admitting that a small insoluble residue of calcareous rock should be remain in place while the waters dissolve and transport the tens and hundreds of feet of thickness of the same rock, induced VINASSA and WALTHER to revive the question some years ago and to admit that the formation of "terra rossa" was largely due to the precipitation of the colloidal ferric hydrate derived from the iron compounds contained in the calcareous rock dissolved by surface water.

In 1911, CHELUSSI studied a large number of samples of "terra rossa" from the Carso of Trieste, the districts of Siena (Tuscany) and Aquila (Abruzzi), and northern Sicily. He found the samples to be composed of ferriferous or aluminiferous granules united with accessory minerals not identical, in quantity or quality, to the minerals present in the insoluble residues of the neighbouring calcareous formations.

In 1912, TUCAN, after having carefully studied and analysed many "terre rosse" from the Croatian Carso, arrived at the unexpected conclusion that they are not essentially constituted by a ferriferous clay, as was previously thought, but by an aluminium hydrate (sporogelite predominating), with which are associated the ferric hydrate and other minerals present in the insoluble residue of the limestones.

In 1913, the author, considering the studies previously mentioned, arrived at the conclusion that "terra rossa" is the insoluble residue of limestones and dolomites, essentially constituted of hydrates of aluminium (sporogelite), nearly always combined with hydrates of iron and other minerals, both authigenous and allothigenous, and that the formation of this soil could, speaking generally, be explained by VINASSA's theory, modified in the sense that the precipitation of the colloidal aluminium hydrate is added or superposed to the precipitation of the colloidal ferric hydrate.

TUCAN does not accept these theories, but considers "terra rossa" (sporogelite and accessory minerals) as a primary formation already present in the limestone, and explains the presence of the insoluble residue by the sieve-like structure of the carsic rock being like a filter, owing to fractures and the slow action of atmospheric agencies. Change of the primitive

(1) See B., 1915, pp. 1133—1138. (Ed.).

deposit can, according to TUCAN, give rise to colloidal secondary formations of oxides of aluminium, iron and manganese.

GALDIERI strongly contests these various theories, and recalls that limestone, as laboratory experiments have shown, dissolves completely in carbonic acid, in which also dissolves the alumino-ferruginous residue resulting from dissolving limestones in dilute acetic and hydrochloric acids, acids which do not exist in a free state in nature.

While studying the limestones and "terre rosse" of southern Italy, GALDIERI found that the residue left after dissolving limestones in acetic or hydrochloric acid does not completely correspond to the residue from "terra rossa". He draws numerous deductions from this fact and proposes to replace previous theories by a new one.

According to GALDIERI, "terra rossa" is simply an aeolian deposit, and in support of such an interpretation he recalls :

- a) the unstratified nature of the deposits of "terra rossa" ;
- b) its predominance in semi-arid regions ;
- c) its presence on tablelands covered with vegetation (which are the places most liable to the accumulation of aeolian deposits ;
- d) its mineralogical and morphological constitution.

Further, the fact that "terra rossa" is usually found on pure limestone has been exaggerated, so GALDIERI thinks, on account of theoretical conceptions ; in any case, he explains it by the permanency of pure limestone and its great permeability. GALDIERI attributes the high iron-content of "terra rossa" to the fact that it is retained in the state of a colloidal hydrate because of the special physico-chemical conditions of both it and the medium. He is of the opinion that the presence of aluminium hydrate is due to a true process of laterisation carried out under warmer climatic conditions than the present ones.

The author remarks that, to be able to judge the value of GALDIERI's theory, it would be necessary to carry out long researches not only in those regions studied by the latter, but also in other regions where the deposits of "terra rossa" are on a larger scale.

Speaking broadly, the writer observes that GALDIERI's strong criticism of the fundamental idea generally admitted cannot be considered as final, but in any case, no matter what the fate of his hypothesis, it has certainly been the means of stimulating more close and searching attention to the questions concerning the origin of "terra rossa".

7 - **Adsorption by Soils.** — HARRIS, J. F., in *Phys. Chem.*, XXI, 454-473, 1917 ; abstracted in *Journal of the Society of Chemical Industry*, Vol XXXVI, No. 19, p. 1057. London, Oct. 15, 1917.

Experiments were undertaken to determine whether the acidity of those soils which redden litmus paper, but which give a neutral solution, is due to colloidal adsorption. Soil was placed in contact with dilute solutions of barium chloride for 24 hrs., with occasional shaking, and the barium in solution before and after the treatment determined. When the results were calculated according to the equation  $\frac{x}{m} = ac^{\frac{1}{n}}$  (1), representing the adsorption



isotherm, the values obtained for  $\frac{x}{m}$  were constant' showing that the action was one of adsorption and not of double decomposition. No chlorine was adsorbed from the barium chloride. Solutions containing other metallic ions were also used, and it was found that the number of equivalents absorbed was the same for ions of the same valency and increased with the valency, except in the case of potassium, which was adsorbed by soil in very high quantity. The potassium absorbed could be recovered by treatment with salt solutions, again in the order of the valency of the metal. When a soil was treated with a solution of two salts, the number of equivalents of each metallic ion adsorbed was less than with each salt separately, but the total number was greater.

**8 - Studies on the Organic Matter of the Soil of the United States.** — I. GORTNER, R. A. (Agricultural Experiment Station, University of Minnesota), Some Data on Humus, Humus Carbon and Humus Nitrogen, in *Soil Science*, Vol. II, No. 5, pp. 395-441, 16 fig., bibliographical index of 31 publications + II plates. New Brunswick, 1916. — II. IDEM, A Study of Carbon and Nitrogen in Seventeen Successive Extracts, with Some Observations on the Nature of the Black Pigment of the Soil. *Ibid.*, Vol. II, No. 6, pp. 539-548, 1 fig., bibliographical index of 5 publications, 1916. — III. IDEM, On the Production of Humus from Manures. *Ibid.*, Vol. III, No. 1, pp. 1-8, bibliographical index of 8 publications 1917. — IV. GORTNER, R. A. (Associate Bio-chemist) and SHAW, W. M. (Assistant in Soils Agricultural Experiment Station, University of Minnesota), Some Data on Humus — Phosphoric Acid. *Ibid.*, Vol. III, No. 2, pp. 99-111, bibliographical index of 24 publications, 1917. — V. MORROW, C. A. (Professor of Chemistry, Nebraska Wesleyan University) and GORTNER, R. A. (Associate Professor of Agricultural Bio-chemistry, University of Minnesota), A Study of the Nitrogen Distribution in Different Soil Types. *Ibid.*, Vol. III, No. 4, pp. 297-331, bibliographical index of 50 publications, 1917.

Since the time of LIEBIG, the nature of the organic matter of the soil has interested chemists, and every year sees extensive contributions to the voluminous literature upon this interesting subject. Mr. GORTNER has chiefly turned his attention to the solution of the following problems:

a) Is the humus, the ammonia, or alkaline hydroxide extract of soils a typical soil product, formed in the soil by the action of bacteria, or can similar extracts be obtained from unchanged vegetable material?

b) Does the humus, "the matière noire" of Grandeau, consist entirely of one or more black compounds, or does it contain in addition a greater or less proportion of colourless substances whose presence is masked by a black pigment?

c) Does a 4 per cent. sodium hydroxide solution extract the same substances and in the same proportion as a 4 per cent. ammonium hydroxide solution?

d) Is the soil nitrogen present in a form different from that in which the nitrogen occurs in plant materials, or does the nitrogen of the soil exhibit the same solubilities as vegetable nitrogen?

**I. — DATA RESPECTING HUMUS, ITS CARBON AND NITROGEN.** — The writer selected air-dried samples of: 8 mineral soils; 3 peats; 1 very acid

(1) FREUNDLICH equation:  $\frac{x}{m}$  being the concentration of the adsorbed substance in the adsorbent,  $c$  the equilibrium concentration of the solution;  $a$  and  $n$  are two coefficients variable with the temperature and the nature of the substances employed. (*Fd.*)

"muck" soil; 5 kinds of unaltered vegetable material and in these he estimated the :

- 1) total carbon and total nitrogen.
- 2) Carbon and "humus" soluble in 4 per cent. ammonia before and after leaching the samples in 1 per cent. hydrochloric acid.
- 3) Carbon and nitrogen soluble in 4 per cent. sodium hydroxide, both before and after leaching.
- 4) Carbon and nitrogen extracted by 4 per cent. sodium hydroxide from the *residue* remaining after the samples had been extracted with 4 per cent sodium hydroxide and then leached with hydrochloric acid.
- 5) Carbon and nitrogen extracted by water from the residue of extract 4.
- 6) Nitrogen soluble in 1 per cent hydrochloric acid.

The various solutions were also submitted to colourimetric determinations.

From the numerous analytic data he obtained, the writer concluded that :

1) The humus extract of mineral soils and peats is not a typical soil product, for very similar extracts can be obtained from unchanged vegetable materials.

2) "Humus", the "matière noire" of Grandeau, does not consist of one, or more, black compounds, but it also contains a large proportion of almost colourless substances, the presence of which is normally masked by the black colour. In fact, the humus extract of Sphagnum peat, of brown peat, or of unaltered vegetable material, has a red-brown colour which only appears black in concentrated solutions.

3) A 4 per cent. solution of sodium hydroxide does not extract either the same substances, nor the same quantity of substances as does a 4 per cent. solution of ammonium hydroxide. Thus, from a given soil, after leaching with 1 per cent. hydrochloric acid, ammonium hydroxide will extract *less carbon* and at the same time *more colour* than will a sodium hydroxide solution.

4) In general, the forms of soil nitrogen appear to be quite similar to those forms occurring in unchanged vegetable materials (sweet fern leaves, oak leaves, oat and lucerne plants) except that they are less soluble in 1 per cent. hydrochloric acid and in 4 per cent. sodium hydroxide.

5) All the mineral soils studied and one calcareous peat, contained a *very dark* soil *pigment* which is absent from the unchanged vegetable materials. This pigment appears to be the only substance which can, with certainty, be said to be a true soil product. It is suggested that perhaps it is of bacterial origin, but as it contains a relatively small proportion of nitrogen, it would appear to have but little importance, *per se*, in the problem of soil fertility.

6) Inasmuch as the "humus" extract of soils is undoubtedly a mixture of organic compounds, many of which are colourless, and in all probability are extracted from unchanged plant or animal materials, and inasmuch as the soil pigment present in this solution probably rarely exceeds 40 per cent. of the "humus", a determination of the "humus" as ordinarily carried out, appears to be wholly without scientific justification. It ap-

pears to be far preferable to determine the humus from the total organic carbon.

II. — A STUDY OF CARBON AND NITROGEN IN 17 SUCCESSIVE SOIL EXTRACTS. OBSERVATIONS ON THE NATURE OF THE BLACK PIGMENT OF THE SOIL. — With a view to isolating this pigment, the writer proceeded as follows :

A sample of silt loam was leached with 1 per cent. hydrochloric acid and then extracted 9 consecutive times with fresh portions of a 4 per cent. sodium hydroxide solution. A sample of the residual soil was removed in order to determine the carbon, nitrogen and humus present. The remainder was further extracted for 4 consecutive times with a 25 per cent. solution of sodium sulphate (to act on the flocculation of the clay), then twice consecutively with the same solution to which was added 15 per cent. sodium hydroxide solution. Part of the residue was used for the determination of the carbon and nitrogen ; the remainder was again leached with hydrochloric acid, and then extracted with 1 per cent sodium hydroxide solution. The extract obtained was divided into 2 portions: one for the determination of the carbon after the flocculation of the clay by potassium sulphate, the other for the determination of the humus after the flocculation of the clay by ammonium carbonate. The final residue was dried and used for the humus determination. The black pigment was separated by precipitation with sulphuric acid from the extracts obtained with sodium sulphate.

The writer arrived at the following conclusions :

1) The black soil pigment does not dissolve in 4 per cent. sodium hydroxide ; this agrees with the writer's earlier observation.

2) This pigment is soluble in very dilute sodium hydroxide solutions, but is at once precipitated if the amount of the sodium hydroxide is increased to 4 per cent.

3) This pigment is also precipitated by salts of the heavy metals. It forms a water-soluble compound with ammonia when an ammoniacal solution is evaporated to dryness. It is not dialysable.

4) Two attempts were made to prepare the soil pigment in a pure form, but the resulting products contained such a high content of ash (37.47 and 51.17) that the ultimate analysis was unreliable. The pigment with the least ash content gave : Carbon, 61.3 per cent. ; Oxygen, 31.6 per cent. ; Nitrogen 2.8 per cent. ; all calculated to an ash-free basis.

5) The first 6 extractions with sodium hydroxide removed relatively more nitrogen than carbon from the soil, but the remaining 3 sodium hydroxide extractions, as well as the 6 pigment solutions, contained relatively more carbon than nitrogen. The final soil residue had a ratio of carbon : nitrogen very much higher than that of the original soil.

III. — THE PRODUCTION OF HUMUS FROM MANURES. — In order to study this question, the writer carried out the following experiment :

Four earthenware jars, each provided with a hole in the base for drainage, were filled with a mixture of sub-soil and organic materials as follows :

*Jar 1* : — 7 500 gm. of moist sub-soil + 500 gm. of a mixture of silk waste and quartz, containing 4.50 per cent. nitrogen, indicating that about 140 gm. of protein had been added.

*Jar 2* : — 7 500 gm. of moist subsoil + 460 gm. of a mixture of  $\frac{1}{3}$  cleaned wool and  $\frac{2}{3}$  quartz flour, containing 4.53 per cent. of nitrogen.

*Jar 3* : — 7 500 gm. of moist subsoil + 50 gm. of powdered calcium carbonate + 300 gm. high grade "patent" flour.

Jar 4: — 7500 gm. of moist subsoil + 300 gm. alfalfa meal.

A sample was taken of each of these mixtures which was dried in the air, bottled, and set aside for analysis. The remaining soil was placed in the earthenware jars and moistened with water containing approximately 50 cc. of an almost clear suspension of soil bacteria. All of the jars were then planted with barley, but as poor growth was obtained in some of them, the vegetation test was soon discontinued, the barley stalks cut off, and the jars of soil allowed to remain in the greenhouse under fallow conditions, care being taken to keep the air moist.

At the end of one year, samples were taken from each jar representing depths of 0.3 inches and 4 to 6 inches; these samples were dried at 65° C., ground to pass a 1 mm. sieve and bottled for analysis. The remainder of the soil was left in the jar for further action by bacteria and fungi.

During the course of the experiment, some changes were observed in jars 1 and 2. A fortnight after the experiments were started, there appeared in the soil of jar 1, black streaks about 1 to 5 mm. below the surface. In jar 2, there was a layer of black soil 3 to 4 mm. thick, and about 5 mm. below the surface. Below these streaks or layers, the soil was again of its original colour. On the other hand, no noteworthy changes in coloration were to be observed in jars 3 and 4, even after the experiment had been started for one year, though after this period, purple spots appeared throughout the soil of jar 1 and a mould odour, as well as mould mycelia were easily observed. The soil of jar 2 was similar to that of jar 1 except that the spots were black. The soil from jars 3 and 4 had a mouldy odour, but no black or purple coloration, so that the presence of mould mycelia cannot be definitely taken as the causation of the black or purple colours.

The determinations of the organic carbon, nitrogen and humus made at the beginning and end of the experiment gave the following results:

1) In all the jars there was observed a decided loss of organic carbon, ranging from 18.4 to 55 per cent. of the carbon originally present.

2) There was likewise a loss of nitrogen, but this loss was not proportional to the loss of organic carbon, ranging from 5.0 to 26.5 per cent. of the nitrogen originally present.

3) There was a loss of humus soluble in 4 per cent. ammonia, and this loss was proportional to the loss of nitrogen. Whether, however, there is a causal relationship here can only be determined by more extended work.

4) As regards the humus extract by 4 per cent. ammonium from the unleached soil, no significant change was apparent in 3 of the jars, but in the 4th, there was a loss of 60 per cent.

5) These experiments furnish no evidence that an increase of soil "humus" is brought about by specific humification. On the contrary, all the evidence is directly opposed to such a conclusion, and it appears altogether probable that the maximum amount of ammonia soluble material is present in the soil immediately after a green manuring crop has been ploughed under, and before the "humifying" bacteria or fungi begin their work.

IV. — SOME DATA ON HUMUS PHOSPHORIC ACID. — The writers determined the phosphoric acid extracted from soils, peats and unchanged vegetable materials: a) by means of 1 per cent. hydrochloric acid; b) by 4 per cent. ammonia, after leaching with the above acid; c) by ammonia without leaching with hydrochloric acid.

The different extracts were evaporated to dryness and the burnt residue was used for analysis. The following conclusions have been reached:

1) Of the 8 mineral soils investigated, 7 yielded more phosphoric acid when extracted with 4 per cent. ammonia than when 1 per cent. hydrochloric acid was used; only in 1 soil did hydrochloric extract appreciably more phosphoric acid than did the ammonia.

2) There appears to be no relation between the amount of phosphoric acid ( $P_2O_5$ ) extracted by ammonia from the soil unleached with hydrochloric acid (HCl.) and that extracted after leaching.

3) The amounts of humus-phosphoric acid present in the 8 soils studied, when compared with the known fertility of these soil types do not support the theory that a high humus-phosphoric acid content is a necessary factor in soil fertility.

4) Probably the greater part of the phosphoric acid present in humus ash is inorganic in nature, being derived from the colloidal clay and from the phosphoric acid ( $P_2O_5$ ) adsorbed by the colloids present in the ammonia solution. No method of analysis has yet been proposed which will distinguish between such adsorbed phosphoric acid and organic phosphoric acid.

5) There is no relationship detectable between the total nitrogen content of the soil and the phosphoric acid ( $P_2O_5$ ) extracted by the different treatments.

6) The amount of "humus ash" (even when the extractions have been carried out under identical working conditions) is extremely variable, from 6.7 to 32.6 per cent. Such a wide divergence can only be accounted for by the presence of considerable amounts of clay, or adsorbed mineral materials.

7) The "humification" of vegetable materials in contact with a mineral soil for an entire year did not increase the humus-phosphoric acid over that contained in the original subsoil.

8) What has been said regarding the colloidal adsorption of phosphoric acid ( $P_2O_5$ ), applies with equal force to determinations of humus-potash, and it is most probable that organically-bound potash does not occur in the soil in appreciable amounts, but that this alkali is found everywhere in a mineral condition and adsorbed.

V. — NITROGEN DISTRIBUTION IN THE DIFFERENT SOIL TYPES. — In these investigations, the writers used the following substances:

a) Fibrin hydrolysed in the presence of an ignited mineral subsoil, in the presence of stannous chloride.

b) A calcareous black peat.

c) An acid sphagnum-covered peat, hydrolysed alone, in the presence of a mineral subsoil, and in the presence of stannous chloride.

d) Seven samples of mineral surface soil: 1 clay loam — 3 silt loams — 1 prairie-covered loess — 1 forest-covered loess.

e) An acid "muck" soil.

f) Extracts of sphagnum-covered peat soluble in: 1 per cent. hydrochloric acid; 4 per cent. sodium hydroxide and not precipitated by hydrochloric acid; 4 per cent. sodium hydroxide but precipitated by hydrochloric acid.

For the separation by hydrolysis, and the determination of the

different forms of nitrogen the writers used the VAN SLYKE method (1), modifying it a little, in order to obtain the following categories :

Total nitrogen.

Ammonia nitrogen.

Humin nitrogen (under the form of "humin") insoluble in soil.

Humin nitrogen, precipitated by calcium hydroxide.

Total humin nitrogen.

Basic nitrogen set free as ammonia by 50 per cent. potassium hydroxide.

Basic nitrogen not set free by this treatment.

Amino-nitrogen of bases.

Non-amino-nitrogen of bases.

Amino-nitrogen in filtrate from bases

Non-amino nitrogen on this filtrate.

Total nitrogen regained.

From the many results obtained, the writers conclude as follows :

1) The figures for the ammonia nitrogen in a protein analysis are not appreciably changed when the hydrolysis is carried out in the presence of the protein material.

2) The "humin" nitrogen is greatly increased by hydrolysis in the presence of ignited mineral soil. The histidine fraction entirely disappears.

3) The analysis of a pure protein in the presence of an ignited mineral soil does not give reliable results for the different fractions. Therefore the figures obtained for the nitrogen distribution in soils are of value only when used for purposes of comparison. Such data should not be compared with analyses of pure proteins.

4) Since practically all the mineral soils investigated give furfural on treatment with an acid, it is very likely that a considerable amount of the total humin nitrogen found is due to the presence of carbohydrates in the soil which give rise to furfural during hydrolysis. This may combine with certain of the nitrogen compounds of the soil and cause an increase in the humin nitrogen, as well as adsorb or occlude nitrogenous compounds in the "humin" formed from furfural by polymerisation.

5) Special attention should be given to a new fraction of nitrogen discovered in these investigations. This is a fraction removed from a colourless solution by the addition of calcium hydroxide (3.26 to 9.21 per cent. of the total nitrogen). It must consist almost entirely of non-protein substances, since the organic substances in this precipitate are colourless

(1) VAN SLYKE D. D. : I. Eine Methode zur quantitativen Bestimmung der aliphatischen Amino-gruppen; einige Anwendungen derselben in der Chemie der Proteine, des Harns und der Enzyme, in *Berichte der Deutschen Chemischen Gesellschaft*, Vol. 43, pp. 3170-3181, 1910. — II. The Analysis of Proteins by Determination of the Chemical Groups Characteristic of the Different Amino-Acids, in *Journal of Biological Chemistry*, Vol. 10, pp. 15-55, 1911. — III. The Quantitative Determination of Aliphatic Amino Groups, *Ibid.*, Vol. 12, pp. 275-284, 1912. — IV. Improvements in the Method for Analysis of Proteins by Determination of the Chemical Groups Characteristic of the Different Amino-Acids, *Ibid.*, Vol. 22, pp. 281-285, 1915.

and adsorbed by, or combined with, the metallic hydroxides (of calcium, aluminium, iron).

6) *True* humin nitrogen (22.93 to 28.27 per cent.) remains in the residual soil after hydrolysis, in company with non-humin nitrogenous compounds.

7) The strength and volume of the hydrochloric acid used in hydrolysis has little effect on the nitrogen distribution of the hydrolysate, provided acid as strong as constant-boiling acid is used, in the proportion of at least 2 parts of acid for 1 of soil. In this manner, the writers extracted on an average 72.19 per cent. of the total nitrogen, with a minimum of 66.63 per cent, and a maximum of 77.65 per cent. The average of the results obtained by other investigators in the case of 37 very different soils, appears to be 75.19 per cent of the total nitrogen.

8) On comparing different soils, it is seen that organic nitrogen dissolves during hydrolysis to almost the same extent, regardless of the origin and nature of the soil,

9) On comparing the different extracts from sphagnum-covered peat, very interesting results were obtained. The portion soluble in sodium hydroxide and *not* precipitated by hydrochloric acid, gave a nitrogen distribution approximating very closely that of a normal plant protein. On the other hand the nitrogen dissolving in the preliminary hydrochloric acid leaching showed a nitrogen distribution which is certainly not due exclusively to protein materials, *e. g.* an ammonia nitrogen percentage of 65.40 and amino-nitrogen in filtrate from bases, of 17.11 per cent.

10) The most significant fact brought out by this study is, that the nitrogen distribution is very *uniform* in *different* soil types. This is to be expected, seeing that the nitrogen distribution in soils is an *average* distribution of all the plant and animal nitrogenous products that find their way into the soil.

9 - Construction and Use of Farm Weirs for Measuring Small Streams of Irrigation Water, in U. S. A. — *United States Department of Agriculture, Farmers' Bulletin 831*, 18 pp., 5 fig., 7 tables, bibliographical index of 20 publications. Washington, June, 1917.

Irrigation is becoming more and more extensive in the arid west of the United States. In order to measure the water supplied by irrigation concerns, the author describes the construction of weirs for measuring comparatively small streams of flowing water.

The weirs described are: *a*) the rectangular; *b*) the CIPOLLETTI (trapezoidal); and *c*) the 90° triangular-notch types. The latter form deserves to be more widely used than at present for measuring small quantities of water.

The dimensions for constructing permanent or temporary weirs are given, as well as discharge tables calculated for various heights of water by the ordinary formulae.

The bulletin closes with a list of 20 publications of the U. S. Department of Agriculture relating to irrigation.

TILLAGE AND  
METHODS OF  
CULTIVATION

10 - **Electrocultural Experiments in Great Britain and France.** — I. BLACKMAN, V. H. and JÖRGENSEN, J. (Imperial College of Science and Technology), The Overhead Electrical Discharge and Crop Production, in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 1, pp. 45-49, figs. 5 London, 1917. — II. JÖRGENSEN J., in *The Electrical Review*, pp. 452 and 454, October, 1916; pp. 497-501, November 1916, pp. 21-23, July, 1917, London. — III. ANGOT A., L'ETIT, H., SAGNIER, H., MANGIN, L. and SCHRIBAU, in *Comptes rendus des Seances de l'Academie d'Agriculture de France*, Vol. III, No. 37, pp. 1054-1062. Paris, 1917.

I. — The account of experiments carried out in 1916 at Lincluden Mains Farm, Dumfries, and continuing those of previous years (1). The object was to study the effect of the overhead electric discharge upon crop production, the experimental crop being oats.

*Description and Treatment of Selected Area.* — A large field of 9 acres, which had in the past given uniform crops, was selected; the soil was a sandy loam. It had been pastured without manure for the 3 previous years. One acre was chosen as the electrified area; the sides of the rectangular plot measured 88 by 55 yds. Two half-acre control plots were chosen at such a distance from the electrified plot as to receive practically no discharge. The difficulty of confining the discharge to the special area to be electrified was much reduced by keeping the wires low (2). The distance of the control plots, together with the low position of the discharge wires, made the use of the earthed screen of wire netting previously used to prevent the spread of the discharge to the control areas, unnecessary.

The overhead discharge was applied by means of a series of 21 wires running parallel to the sides of the rectangular special area. The wires were about  $4\frac{1}{2}$  yds. apart and supported at their ends at about 7 ft. above the ground (at the end of the experiment, the wires had sagged downwards to a height of only 6 ft.). One end of the wires was connected to the soil and the other to the secondary circuit of an induction coil, producing a potential of about 90 000 volts on the wires. Two ball interrupters, placed in the circuit, gave sparks some 6 inches long. A series of LODGE valves were introduced to reverse the current (3). The primary circuit of the induction coil received, through a rotary mercury interruptor, a 3-ampere current at 50 volts, as in preceding years, but the intensity of the discharges was much greater, the wires being so much closer together ( $13\frac{1}{2}$  ft. against

(1) See *The Journal of the Board of Agriculture*, April, 1910, p. 16; January, 1912, p. 862; October, 1913, p. 582; January, 1915, p. 944; and October, 1916, p. 671 (*Authors' note*). — For an account of the 1915 Experiments at Lincluden, see *R.*, 1916, No. 1260. (*Ed.*)

(2) JÖRGENSEN and PRESTLY have shown (*Journal of Agricultural Science*, Vol. VI, Part 3, pp. 337-548, 1914) that when the wires are fixed at a considerable height above the ground the wind may carry the discharge over a wide area. (*Authors' note*). — This article was summarised in *B.*, 1915, No. 17, under the title: *The Distribution of the Overhead Electrical Discharge Employed in Recent Agricultural Experiments.* (*Ed.*)

(3) See *The Electrical Review*, October and November, 1916, pp. 452, 454, 499-501.



14 ft. in 1915 and 19 ft. in 1914), as well as nearer the soil (7 ft. against 10 in 1915 and 14 in 1914) (1).

*Effect of the Discharge on the Crop.* — The oats were sown on March 27 and appeared above ground on April 13, the discharge being started on April 14. By May 16, there was a marked difference between the electrified and the control areas; the plants which had received the discharge were taller and of a deeper green colour than the others.

Measurements were taken at intervals of the average height of the plants of the three areas; the results are given in the following table:

Plots	18th. June	25th. June	3rd. July
Electrified . . . . .	19 in	24 in	32 in
Control I. . . . .	14 "	19 "	21 "
Control II . . . . .	12 "	18 "	20 "

Measurements were discontinued after July 3, it not being possible to get among the plants without damaging them. The effect of the discharge was clearly visible for some distance round the electrified area, or the height of the crop round the area was above the average, gradually diminishing with increasing distance.

The electrified crop was markedly taller than the rest of the field, as is well shown in 2 photographs, taken on August 8.

The discharge was continued until August 17, being used only in the daytime and discontinued during rain. It was applied for 848 hours altogether during the season.

Heavy rain storms set in during the latter part of August, causing considerable laying of the heavy electrified crop and delay in cutting. This led to failure to garner the whole crop, owing mainly to loss of grain before harvesting. The crop was cut on August 28 and 29, carted on September 11, and threshed on September 12. The yields in grain and straw are given below.

	Grain			Straw
	1st Quality	2nd. Quality	Total	
Electrified Area (1 acre) . .	1 942 lb.	695 lb.	2 637 lb.	4 924 lb.
Control Area I ( $\frac{1}{2}$ acre) . .	630 "	210 "	840 "	1 218 "
Control Area II ( $\frac{1}{2}$ acre) . .	714 "	210 "	924 "	1 401 "

The electrified area, as compared with the control areas, gave an increased yield in grain of 49 per cent., and in straw of 88 per cent. If the

(1) The intensity of the charge received may be increased by: a) lowering the wires; b) reducing the distance between the wires; c) reducing the thickness of the wires. The wire used was silicium bronze of gauge 24.  
(Authors' note)

weather had been more favourable, the yield of grain would have been greater. The 1915 results, also with oats, but with a weaker discharge, gave 30 per cent. increase in grain and 58 per cent. increase in straw.

*Financial Results.* — Taking current prices in the district at the end of September, 1916 (oats, first quality, 3s. 9d. per bush.; 2nd. quality 3s. 1d. per bush.; straw, £2 15s. per ton), the increased value of the crop works out (with bushels of 42 lb.) at £6 7s. per acre.

The net profit is rather difficult to estimate. The apparatus used to produce the high-tension current was inefficient, not being such as would be used for work on a large scale; for every 100 watts in the primary circuit only 10 or 12 watts were obtained from the secondary one. Thus, with an efficient apparatus, the same cost would have enabled discharges to be made over a much larger area.

In addition, current supply from a power station was not available, so the supply was obtained from a small dynamo driven by a petrol engine. The cost of the current used, about 130 B. of T. units, when calculated at 1d. per unit, only works out at 11s. The cost of a large-scale installation cannot be estimated at present, but the profit shown above would permit of a heavy expenditure on an installation.

*Residual Effect of Discharge.* — A new and important aspect of the problem has been disclosed by the discovery that the application of the discharge one year may increase the next year's crop. The field in which the experimental crop was grown in 1915 was sown with grass and clover at the same time. The difference between the crop of clover-hay produced in 1916 on the electrified area of 1915, and that on the non-electrified area, was very obvious, and there was a marked increase in the weight of the crop produced from the electrified area. Two photographs, taken on September 15, show the *second* crop of clover which had come up on the hay stubble; the first crop of clover hay had been cut in July, 1916. The difference in growth on the two areas was very marked. It should be noted that this field had been well limed before sowing the oats. This question of "after-effect" will be investigated in future experiments, as if the electric discharge may benefit a succeeding crop, its agricultural value will be greatly enhanced.

*Problems still needing Investigation.* — The writers conclude that the use of the overhead electric discharge is not sufficiently investigated as to warrant its practical adoption. The most suitable strength of discharge has yet to be ascertained, as well as the most economical methods of producing the necessary high tension current. There also remain the questions of the light, humidity of the air, nature of the soil, etc., to be studied.

II. — An account of other electro-cultural experiments carried out in various districts of England in 1916. The following are the principal results:

*Strawberries.* — The electric discharge produced an increase in yield of 80 % for young plants, and of 25 to 30 % for old plants.

*Potatoes.* — Increased yield of 20 to 50 % bearing, not on the number of tubers, but on their size.

*Carrots, Beets, Tomatoes.* — Increased yield of from 25 to 50 %.

*Leguminous Plants.* — The immediate effect of the discharge was somewhat harmful to these plants, which fix atmospheric nitrogen, whilst they benefited from the *after-effect* of the previous year's discharge, as was seen above for clover.

*The Electrical Review* for July 6, 1917, describes a portable outfit containing all the necessary apparatus for producing discharges over an area of from  $1\frac{1}{2}$  to  $2\frac{1}{2}$  acres. The maker offers to supervise the installation personally and supervise the working of the apparatus.

III. — At the meeting of the French Academy of Agriculture on November 28, 1917, M. ANGOT described Messrs. BLACKMAN and JÖRGENSEN's experiments, as well as other trials carried out in England. The communication was followed by a discussion, summarised below.

M. PETIT: The good effect of the electric discharge appears to be due to a greater *mobilisation* of the elements necessary to plant-life. If the leguminous plants only profited from it the second year, it is because they derive no benefit from the nitrification of nitrogenous manures during the first year; in fact, they suffer from excess of nitrogen. In continuing these experiments attention should be paid to this danger: in using the soil, good results might be obtained at first, but negative results might be obtained after some years' time.

M. ANGOT: The authors of the Lincluden experiments make all necessary reserves themselves. It is not the soil that is electrified, for the wires are 7 feet above the ground; the discharges act directly on the plants.

M. H. SAGNIER: The question of the agricultural use of electricity is not new to France. Several sets of experiments have been made concerning the action of electricity on plants. Thus, GRANDEAU carried out experiments in a metallic cage; a professor of the Agricultural Institute at Beauvais invented a system similar to a lightning-conductor and which gave results varying from good to mediocre.

M. L. MANGIN: Many attempts have been made in France to utilise atmospheric electricity; but it has but a feeble influence, and its use is limited, while in the experiment in Great Britain powerful currents were used, obtained by induction coils, which is very different, especially in the intensity of the action on the plants.

M. SCHRIBAUX has made thousands of experiments with large metallic cages; he found no marked difference between plants growing in the cages and those growing outside; the differences found seem due rather to experimental errors, and atmospheric electricity does not seem to have produced any noteworthy effect on the Gramineae experimented with. The poor results obtained in previous attempts were probably due to the agriculturist's lack of electrical knowledge and the physicist's lack of agricultural knowledge. The two experts should combine their efforts.

Finally, M. ANGOT considers that previous experiments cannot be compared with those made recently in Great Britain. In using atmospheric electricity only a feeble potential is obtained; the current only increases

by 30 or 40 volts per yard of elevation; when the wires are placed from 12 to 16 ft. above the soil, less than 150 to 200 volts are obtained. On the other hand, industrial currents producing up to 90 000 volts were used in the trials in Great Britain, so no comparison whatever can be made between the two procedures. Plants sheltered under a cage are simply submitted to the action of atmospheric electricity, which also influences the plants outside the cages, but the difference is very small. At a few inches from the ground, the difference of potential between air and soil does not exceed a few dozen volts; this would explain the contradictory results obtained by M. SCHRIBAUX.

11 - The Cultural Methods Applied to Winter Wheat in the Great Plains Area, U. S. A. — CHILCOTT, F. C., COLE, JOHN S. and KUSKA, J. B., in *United States Department of Agriculture, Bulletin* No. 595, 36 pp. 19 tables. Washington, October 11, 1917.

The Office of Dry Land Agriculture of the U. S. Department of Agriculture began field work in the investigation of methods of crop production in the Great Plains area in 1906. In 1916, 24 Agricultural Stations were occupied with experiments in crop production.

The bulletin analysed compares the returns obtained with different methods of cultivating winter wheat, using for the purpose the results of 75 annual cultural experiments carried out on 1137 plots by 13 Stations (1) which had made cultural experiments for a period of at least 4 years.

The area covered by these investigations consists of about 400 000 square miles of territory. It includes the western portions of North Dakota, South Dakota, Nebraska, Kansas, Oklahoma, and Texas, and the eastern portions of Montana, Wyoming, Colorado and New Mexico. These experiments supplied a large number of details which are summarised in the bulletin, so as to give only the most general and most important results.

After examining the results of the experiments of the 13 Stations, each of which is considered separately, the writers came to the following conclusions :

None of the cultural methods investigated, when applied to winter wheat, can overcome extremely unfavourable climatic conditions. It is only in the case of rainfall deficit, that the cultural methods under investigation have shown important effects upon yields.

Reducing the cost of production has, in most cases, proved a more important factor in determining profits, than increasing the yields by cultural methods.

The average difference in yields between early (deep : 8 inches), and late (shallow : 4 inches), ploughing is 1 bushel per acre. At most Stations, the difference is small, while at others the advantage of one over the other depends on the season.

The preparation of the ground after harvest : furrowing with a lister, and levelling the ridges preparatory to seeding, have resulted in an average increase of 0.9 bushel per acre over early ploughing and 2.2 bushels per

(1) See R. April, 1917, No. 328. (*Ed.*)

acre over late ploughing. As it is a cheaper method of preparation than ploughing, it has consequently been more profitable.

Subsoiling has increased the yields over ploughing without subsoiling at 5 Stations out of the 10 at which it has been studied. In the other Stations, this method has been the least remunerative.

Disked maize ground has given consistently high yields. This, together with the low cost of preparation, has resulted in this method showing the highest net returns of any of the methods at all the 11 stations where it has been tried, except at Huntley and Amarillo.

Summer tillage has given the highest average yields of any method under trial. However, on account of its high cost, due to extra labour and alternate-year cropping, it has not netted the highest returns, except at Huntley.

Green manuring is the most expensive method under investigation. It has given the smallest net returns of any of the methods at all the stations, except Huntley, where the profit from it is slightly greater than from either autumn ploughing or subsoiling.

12 - Method of Rice-Growing in Uncultivated Rice-Fields, in Italy. — See No. 37 of this Review.

13 - Improved Method of Sugar Cane Cultivation, in Salvador. — See No. 46 of this Review.

14 - The International Trade in Fertilisers and Chemical Products Employed in Agriculture (Half-Yearly Review) (1). — *Bulletin of Agricultural and Commercial Statistics*, Year VII, No. 9, p. 731-786. International Institute of Agriculture, Bureau of Statistics, Rome, September, 1917.

MANURES  
AND MANURING

This Review comprises nearly sixty pages, with a great number of data, either official or from trustworthy authorities. Separate headings are devoted to each of the principal fertilisers (*phosphatic, potassic and nitrogenous*) and chemical products employed in agriculture. The more important data are given below.

#### I. - The world's production.

NATURAL PHOSPHATES. — The production of natural phosphates in the United States, after having undergone some decrease in 1914, was in 1915 only about one-half of that of 1913 but recovered somewhat in 1916. According to data supplied by producers, the aggregate of natural phosphates sold in the United States in 1916 was 2 014 196 tons, against 1 865 123 tons in 1915.

Florida has produced 47 843 tons of rock phosphate, and 1 492 327 tons of pebble. The small extent of production of the first mentioned will be noticed, having declined since 1915, from a total of nearly 500 000 tons in 1913.

The figures from South Carolina, continuously on the decline, afford only 53 898 tons, less than half the production in 1913.

The production of Tennessee and Arkansas for 1916 is 369 951 tons of brown rock phosphate and 48 447 tons of blue grey phosphate, making a total of 418 398 tons.

This total includes a small quantity of brown rock phosphate from Kentucky and shews a decided increase on the figures of 1915.

(1) See R. January, 1917, No. 13. (Ed.)

In the western states only Utah and Wyoming contribute to the production of rock phosphate, as Idaho has now ceased to produce. The quantity from those two States was 1 730 tons in 1916, less than half that produced in 1915.

Makers of fertilisers claim that the price of phosphatic fertilisers should show a much greater increase than that of the rough phosphate, and that the rise is required in order to meet the enhanced price of the sulphuric acid required in the preparation of fertilisers. It is anticipated that the improvement in the manufactured quantities of natural phosphates, manifest in 1916, will continue during 1917.

The production of Egypt in 1916, amounting to 125 008 tons, shows a decided advance on that of 1915, and this also applies to Tunis. On the other hand the data from the Dutch West Indies and the French settlements in Oceania indicate a marked decline.

The subjoined table contains the principal numerical data recently to hand with regard to this subject. These data appear in the review published by the International Institute of Agriculture in Rome.

Natural phosphates	1916	1915	1914	1913
—	—	—	—	—
	thousands of metric tons			
Spain . . . .	14	9	8	4
United States .	2.014	1.865	2.778	3.161
Dutch Antilles.	14	29	15	36
Algeria . . . . (a)	380	165	226	461
Egypt . . . .	125	83	72	104
Tunis . . . .	1.695	1.389	1.444	2.285
French islands				
in the Pacific (b)	27	72	73	82

(a) Shipments. — (b) Shipments of the first nine months.

**BASIC SLAG.** — It is an exceedingly difficult matter to prepare an international table with regard to basic slag, in present circumstances. The production of Germany in the first ten months of 1916 was 1 592 thousands of tons, as compared with 2 500 in 1913. Production of this commodity has also decreased considerably in all other countries.

**SUPERPHOSPHATE OF LIME.** — The International Institute of Agriculture has published the following summary:

Superphosphate of lime	1916	1915	1914	1913
—	—	—	—	—
	thousands of metric tons			
Spain . . . .	315	194	220	225
France . . . .	350	600	1.600	1.920
Great Britain .	—	685	—	820
Italy . . . . .	848	913	906	972
United States .	—	2 533	3 785	2 348

**POTASH SALTS.** — The German distribution department for production of potash has fixed the following aggregate for the year 1917:

Germany . . .	762 250 tons of pure potash
Other countries	155 200       "       "
Total . . .	<u>918 450</u> "       "

The deliveries of German potash salts in 1916 reached a total of 883 696 tons of pure potash, against 680 005 tons in 1915, 903 988 in 1914, and 1 110 370 tons in 1913. The considerable increase in the production of 1916 as compared with that of 1915 is explained by the fact that the requirements of German farmers have been better distributed over the whole year, and were consequently more uniformly met.

The production of potash salts in the United States in 1916 was estimated at 32 422 metric tons of products with an average of about 7 % of potash,

representing a production of potash amounting to 8818 tons. This is very nearly ten times the production of 1915, but no more than one-twentieth of the normal consumption of potash in the United States.

**NITRATE OF SODA.** — The production of the Chilean nitrate beds in the first half of 1917, was very nearly equal to that of the corresponding period in 1916; being 1 482 122 metric tons in 1917 and 1 488 792 in 1916. In fact after an interval of a year and a half a production analogous to that of peace times has again been attained. In the first half of 1915 a minimum was established on a production of about 600 000 tons. The stocks on 30 June have never been so large as as those of this year, on the Chilean coast.

They amounted to 936 235 tons, while they were 919 102 tons at the same date in 1916, about 850 000 tons in 1915 and 775 000 tons in 1914. In previous years the figures were still more moderate. The reason for this abnormal increase of stocks must be sought in the fact that, while production totals shew little change, the shipments to European and American markets have been much hampered by the lack of tonnage and by the consequent enhancement of freight rates. These shipments represent during the first half of 1917 a total of 1 230 947 tons against 1 356 629 tons in 1916, say 125 082 tons less in 1917.

These figures are however much larger than those of the first half year of 1915 which only reached 834 376 tons.

**SULPHATE OF AMMONIA.** — A production of 700 000 tons of sulphate of ammonia was expected in Germany for 1916, while, according to the most recent available data, the quantity for 1915, was 549 000 tons.

Owing to the enormous demand for steel, both for European countries and for American foundries, and the fact of the production of ammonia being based on the metal requirements, the production of sulphate in the United States has greatly increased since 1914.

In 1916 this production of ammonia, reckoned in sulphate, was about 294 838 metric tons, or 47.7 % more than in 1915. The increase is still clearer when the data are compared with those of 1914, when the production was only 166.016 tons.

For 1917 the American production of ammonia is estimated at 400 000 tons, reckoned in sulphate; and the capacity for production in 1918 may reach at least 500 000 tons.

The Japanese production of sulphate of ammonia is also continuously increasing. While in 1914 it scarcely exceeded 16 000 tons, it reached 31 824 in 1915 and in 1916 the total became 28 203 tons. For 1917 the estimate is 50 802 tons, and some people predict a total of 60 000 tons. This increased production is due to the same causes that have influenced the output in America.

The subjoined table summarises the information published by the Institute of Agriculture with respect to production of sulphate of ammonia from 1913 to 1916.

Sulphate of ammonia	1916	1915	1914	1913
	thousands of metric tons			
Spain . . . .	18	16	16	15
France . . . .	25	42	—	74
Great Britain .	445	433	433	439
Netherlands .	4	5	5	7
Russia . . . .	33	16	17	14
United States .	295	227	166	177
Japan . . . .	38	32	16	8
Australia . . .	7	7	6	5

**CYANAMIDE OF CALCIUM.** — Although some authorities estimate the German production of cyanamide in 1915 and 1916 at an aggregate of 600 000 metric tons, others do not reckon it at more than 400 000. We have adopted the

figure of 500 000 tons thus indicated as this appears to us not far from the reality. The American consular reports consider that, besides this production of cyanamide, Germany will recover in 1917 nearly 500 000 tons of ammonia, by the aid of the Haber process, which represents, for that country alone, a total of nitrates extracted from the atmosphere, equal to 200 000 tons. If to this are added the 140 000 tons of nitrates represented by the 700 000 tons of sulphate of ammonia expected in 1917 for that country, we find for Germany an available aggregate of 340 000 tons of nitrate, if we estimate the production of cyanamide in 1917 as equal to those of 1916 and 1915.

There is nothing official in connection with these figures.

Nor is there any other country which provides official data as to the present production of cyanamide, and this may be readily understood, since the whole, or very nearly the whole, of the nitrogenous products of this class are reserved for war work. In the subjoined table we have embodied the estimate as to capacity for production of cyanamide that are made by experts in this question and published by the Institute of Agriculture.

Cyanamide of calcium	1916	1915	1914	1913
	thousands of metric tons			
Germany . . . . .	500	500	36	24
Austria-Hungary . . . . .	24	24	24	7
France . . . . .	100	80	7	7
Italy . . . . .	20	25	16	15
Norway . . . . .	220	25	15	22
Sweden . . . . .		16	18	18
Switzerland . . . . .	29	12	7	7
Canada . . . . .	64	64	64	48
United States . . . . .				
Japan . . . . .	24	24	7	7
World's total . . . . .	981	770	193	155

**SULPHUR.** — The Italian production of raw sulphur during the first half of 1917 is officially estimated at 100 240 metric tons, against 269 374 and 558 107 tons respectively for the complete years 1916 and 1915.

Almost the whole of the sulphur produced in the United States at present comes from deposits in Louisiana and Texas, but deposits that have been, or might be productive, are known in Wyoming, Nevada, Utah, California, Colorado, Oregon and Alaska.

The production of 1915 and 1916 has not been officially estimated. Some authorities on the question reckon that the United States have consumed about 900 000 tons of sulphur, as compared with 300 000 tons in 1913. It is expected that the demand in the States will attain 1 200 000 tons in 1917, and may probably grow to 1,600,000 tons in 1918 if the war continues.

The subjoined table contains the numerical data of import tance taken from the summary made with regard to this product by the Institute of Agriculture:

Sulphur	1916	1915	1914	1913
	thousands of metric tons			
Spain . . . . .	11	10	8	7
Italy . . . . .	269	358	378	386
United States . . . . .	—	(a) 381	381	317
Japan . . . . .	93	61	60	49
Other countries (b) . . . . .	50	50	50	50

(a) Louisiana only. — (b) In round numbers.

**SULPHATE OF COPPER.** — Subjoined are the items of information published by the Institute:



Sulphate of copper	1916	1915	1914	1913
		thousands of metric tons		
Spain . . . . .	8	1	0	0
France . . . . .	27	16	21	26
Great Britain . . . . .	39	66	69	77
Italy . . . . .	48	41	31	44
United States . . . . .	(a) 6	19	14	25

(a) Production of the *American Smelting and Refining Company* only.

## II — International trade.

Owing to the prolongation of the war the extent of international trade in the products under review is considerably diminishing, with the exceptions of exports of nitrate of soda from Chili, and of occasional business in other articles. This reduction is consequent on the scarcity of tonnage and on the resulting very high freights, together with the restrictions and prohibitions of export imposed by the Governments, owing to the more or less important use of these products in manufacture of munitions.

As regards the United States, the nitrate trade continues very active, whilst for European destinations there is a decided tendency towards decrease.

## III. -- Wholesale prices.

Prices for fertilisers have on the whole continued to advance during the first eight months of 1917 and for some products the rise has been quite as pronounced as in the same period of 1916. The enhancement in sulphur has been quite a considerable one.

Quotations on the more important markets for the chief products have been as follows:

	Average of 1916	Average of January 1917	Average of July 1917	Average of the first half of 1917
	in gold francs per quintal			
<i>Chlorate of potash:</i>				
London . . . . .	138	140	149	154
New York . . . . .	207	224	193	218
<i>Sulphate of potash:</i>				
London . . . . .	146	149	161	162
New York . . . . .	163	150	150	150
<i>Nitrate of soda:</i>				
Valencia . . . . .	49	57	67	61
Paris . . . . .	40	48	67	57
Genoa . . . . .	44	58	104	71
Liverpool . . . . .	44	50	62	57
New York . . . . .	37	38	49	43
<i>Sulphate of ammonia:</i>				
Valencia . . . . .	57	79	134	110
Paris . . . . .	51	56	77	64
Genoa . . . . .	51	48	83	52
Hull . . . . .	43	46	53	48
New York . . . . .	43	53	71	61
<i>Raw sulphur:</i>				
London . . . . .	23	29	31	35
Licata (Sicily) . . . . .	13	18	26	20
New York . . . . .	17	18	23	22
<i>Sulphate of copper:</i>				
Valencia . . . . .	190	158	183	169
French Atlantic ports . . . . .	127	138	200	159
London . . . . .	130	161	154	156
Genoa . . . . .	144	n. q.	103	103
New York . . . . .	187	146	114	120

Note: n. q. = no quotation.

In addition to the above mentioned data, which summarise only a small portion of the review made by the International Institute of Agriculture of Rome, there will be found in that review some interesting particulars as to sulphate of copper in France, and the consumption of fertilisers in France and in the United States, etc.

15. — **The Fertilising Value of some Household Wastes.** — BROWNING, P. R., in *Journal of Industrial and Engineering Chemistry*, Vol. 9, No. 11, p. 1043. Easton, Pa., November, 1917.

This paper gives the analyses of the ash of certain household wastes, carried out with a view to establish the results which may be obtained by burning in an improvised incinerator under ordinary household conditions.

Ash	K <sub>2</sub> O per cent.	P <sub>2</sub> O <sub>5</sub> per cent.	Ash	K <sub>2</sub> O per cent.	P <sub>2</sub> O <sub>5</sub> per cent.
Banana stalk . . . . .	49.40	2.34	Cucumber skins . . . . .	27.20	11.28
Banana skins . . . . .	41.76	3.25	Stringbean strings and stems . . . . .	18.09	4.99
Grape fruit skins . . . . .	30.60	3.58	Tea leaf ash . . . . .	0.44	1.60
Orange skins . . . . .	27.00	2.90	Coffee beans (dried) . . . . .	0.67	0.36
Lemon skins . . . . .	31.00	6.30	Lamb-chop bone ash . . . . .	1.62	26.60
Apple skins . . . . .	11.74	3.08	Burned egg shells . . . . .	0.29	0.43
Cantaloupe rinds . . . . .	12.21	9.77	Tobacco . . . . .	16.81	2.57
Raw white potato skin . . . . .	27.50	5.18	Peanut shell ash . . . . .	6.45	1.23
Boiled sweet potato skin . . . . .	13.89	3.29	Peach stones . . . . .	6.04	3.25
Pea pods . . . . .	9.00	1.79	Peach skins . . . . .	30.76	6.31

16. — **Fertilising Value of Waste Cabbage Leaves, in Holland.** — See No. 65 of this Review.

17. — **Fertilising Value of Cider Residues.** — See No. 68 of this Review.

- 18 — **Awards for the Location of Workable Phosphatic Deposits, in Germany.** — I. Bereitstellung von Fundprämien für abbauwürdige Phosphatlager, in *Kunstdünger- Futtermittel- Leim- und Oel- und Fett-Zeitung*, Year 11, No. 16, p. 109. Berlin, 1917. — II. Bereitstellung von Fundprämien für abbauwürdige Phosphatlager, Veröffentlichungen des Preussischen Landwirtschaftsministeriums. *Ibid.*, No. 9, p. 127.

The phosphatic manure requirements of German agriculture were satisfied in peace times chiefly by superphosphates prepared with imported phosphates and by basic slag. The production of the latter has diminished a little during the war, and the imported phosphates can only be replaced in part by those from northern France and Belgium and by the re-opening of the Lahn (Nassau) mines (1), carried out by the War Society for Phosphates.

By the use of new methods it is now possible to work phosphatic rocks which previously were not utilisable for the production of fertilisers. Nevertheless, in order to maintain German agricultural production at a normal level, a larger quantity of phosphatic manure is required. In order to obtain this, awards to the amount of 100 000 *Mark* (1 *Mark* = 11  $\frac{3}{4}$  *d. at par*) have been offered for the location of new phosphate deposits and for their study, either within the German Empire or in the occupied territories in the east. The funds for these awards have been supplied by the Prussian State, the German Agricultural Society, the Union of Manufacturers of Chemical Manures, and the "Rhenania" (Aachen) Factory of Chemical Products. All information with regard to new deposits must be addressed to the Prussian Department of Agriculture, Office for Raw Materials. If the deposits are worked the informant will receive a bonus per ton of mineral extracted.

(1) See BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES, *Production and Consumption of Fertilisers in the World*, 2nd. ed., p. 9. Rome, 1914. (Ed.)

19 - **The Collection of Kelp in the United States for Potash Production.** — *American Machinist*, Vol. 47, No. 14, pp. 599-600, figs. 2. London, November 17, 1917.

Various companies are now gathering kelp for potash production, along the Pacific coast from Los Angeles to San Diego.

The potash produced costs more than that imported before the war from Germany. It remains to be seen whether the cost of production can be sufficiently reduced.

The foliage of the kelp floating on the surface of the water is gathered as it contains most potash. Large barges are used, one end being fitted with a conveyor equipped with knives like those of mowing machines. These knives vary from 10 to 16 ft. in length, and are of triangular shape. The conveyors are sometimes fitted with side knives to clear the kelp completely and make it easier for it to be moved by the conveyor. These knives, as well as the conveyors, are run by chain from a small gasoline engine in the barge.

The conveyor is lowered into the water to the desired depth, usually about 4 to 6 feet. Below this the kelp contains less potash, and it is also more difficult to handle. The barges are usually towed, though some are motor driven. The power required is very small as they only move at the rate of about 2 miles an hour. The barges cost about \$65 000 each and vary greatly in capacity; some can gather 60 tons an hour while others only handle 300 tons in 24 hours. In calm weather the kelp is gathered at a distance of 2 or 3 miles from shore. About 3 crops a year are gathered.

The kelp contains about seven-eighths water and 21 to 22 tons of wet kelp give 1 ton of ash. The ash yields about 32 % of potash, or about 4 % of the weight of the wet kelp.

20 - **20 % Potassium Salt as a Fertiliser.** — VAN STORK, D. (Rijkslandbouwproefstation te Maastricht), in *Verslagen van Landbouwkundige Onderzoekingen der Rijkslandbouwproefstations*, No. XX, pp. 35-12. The Hague, 1917.

Since 1910 the 40 % potassium salt for fertilisers, largely used in Holland, was imported from Germany.

After the war the importation was reduced to limited quantities of a 20 % salt. The analysis of typical samples of this product showed the 20 % salt, like the 40 % one, to be composed chiefly of potassium and sodium chloride with, for example, as much as 50 % of carnalite (double chloride of potassium and magnesium), or large quantities of kieserite (magnesium sulphate).

21 - **The Effect of Different Methods of Inoculation on the Yield and Protein Content of Alfalfa and Sweet Clover.** — ARNY, A. C. and TATCHEK, R. W., in the *Journal of the American Society of Agronomy*, Vol. 7, p. 172-185; Vol. 9, p. 127-137. Washington, 1915, and 1917.

The experiments described were carried out during the season 1914 and 1915 in order to study the effect of different methods of inoculation on the yield and chemical composition of alfalfa and sweet clover, during consecutive seasons in three different plots.

The data collected refer to: — 1) the weight and protein content of three successive cuttings, during each of the two years, on 14 plots of in-

oculated alfalfa and 9 uninoculated control plots ; 2) the weight and protein content of one year's harvest on 2 plots of inoculated sweet clover, and 3 uninoculated plots ; 3) analyses of the aerial parts and roots of 2 consecutive alfalfa harvests and 2 consecutive sweet clover harvests on 3 inoculated and uninoculated plots of 1 square yard respectively.

The results show that, in the experimental plots, inoculation at the time the grain is forming causes a marked increase, at the first harvest, in the unit yields in dry matter and in protein content as compared with the results obtained on the uninoculated plots. During the following season (2nd. harvest), the differences are less marked, and disappear almost completely the following year owing to the rapid propagation of the bacteria inoculated on the uninoculated plots.

The inoculation of either alfalfa or sweet clover with soil from plots on which both had done well had a similar effect ; and, from an experimental point of view, better results were obtained with the inoculated soil than with the commercial cultures used. Liming with 5 ½ bushels of crushed lime per acre during the formation of the grain slightly increased the effects of inoculation.

Amongst these effects was also considered that of giving the plants a greater capacity for utilising the mineral fertilising elements of the soil, in so far as an increased harvest causes a greater loss of potash, phosphoric acid and lime from the soil. Another effect of inoculation is that the plants inoculated can form a slightly larger quantity of dry matter with a given quantity of mineral fertilising elements.

- 22 - *Isopyrum fumarioides*, A New Hydrocyanic Acid-Containing Plant. — MIRANDE, MARCEL, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 21, pp. 717-718. Paris, November 19, 1917.

In *Isopyrum fumarioides* L., a native of Siberia, grown in the Lantaret Alpine Garden, was found a substance which, under the influence of an enzyme, acting in a similar way to emulsine, and also contained in the plant, decomposes giving, among other products, hydrocyanic acid. An estimation by the method of FORDOS and GELIS, in the month of August, showed 100 gm. of fresh plants in full flower and even almost in fruit, to contain 0.249 gm. of hydrocyanic acid. This result places the plants among those most rich in cyanic products.

In a previous note (*Comptes rendus de la Société de Biologie*, November 22, 1913), the author drew attention to the presence of hydrocyanic acid in *Isopyrum thalictrifolius* L., which contained 0.042 gm. per 100 gm. of fresh plant.

- 23 - The Influence of Aeration of the Nutrient Solution in Water Culture Experiments, Remarks on the Water Culture Method. — STILES, W. and JØRGENSEN, J., in *New Phytologist*, Vol. XVI, Nos. 8-9, pp. 181-197, bibliography of 11 works. London, Oct.-Nov., 1917.

The writers emphasize the complexity of problems of water cultures, and endeavour to illustrate it especially in relation to aeration, having obtained similar results of those of HALL, BRENCHELEY and UNDERWOOD in

relation to the increase in growth of barley resulting from aeration (1); on the other hand with buckwheat a result was obtained similar to that of FREE, who found no benefit to result from aeration. It does not follow, however, that the same result would be obtained under all conditions of experiment. It is very likely that there are conditions in which aeration would produce no effect on the rate of growth of barley, or which would increase the rate of growth of buckwheat. The writers show also how different conditions bring about different increases in the rate of growth as a result of aeration.

There is at present no explanation why, under the conditions of the reported experiments, aeration should increase the rate of growth of some species and not of others; whether it is to be correlated with oxygen supply, removal of carbon dioxide, removal of diffusion gradients, or change in solubility conditions or other causes. There seems no doubt, however, that water culture conditions react in a different manner on different species.

It must be emphasized that a great deal of work must be done on the physical chemistry of water culture solutions before work can be done with necessary definiteness. Particularly investigation must be extended on dynamical principles as is clearly indicated from the investigations of PANTANELLI (2).

Further it is obviously desirable to work towards getting some more explicit principle which will take into account the co-operation of the various activities of the plant. It seems clear that at present neither the law of the minimum nor the principle of limiting factors as employed by BLACKMAN in regard to the sub-aerial part of the plant are expressions of our present knowledge of the life of the plant as a whole.

The detachment between plant physiology and agriculture might be removed if a working principle in regard to the physiological relations of plant processes were evolved which embodied the activities of both sub-aerial and subterranean parts of the plant. This is highly desirable, but it must be admitted that it seems remote at present.

24 — **Researches on the Pigmentation of the Ear of Wheat, in Russia.** — ЛЕВИЦКИЙ Ст., (LEVITZKI, St.), in *Журнал по опытной Агрономии* (*Review of Experimental Agronomy*), Vol. XVIII, Part 1, pp. 46-61. Petrograd, 1917.

There are 2 pigments which produce the colour of the glumes and other parts of the ear, namely, carotine producing *red*, and another pigment, of unknown composition, producing *black*. Ears wholly lacking pigment are of a clear straw colour and are described as *white*.

In south east Russia, *white* wheats give better yields, as regards quantity and quality, than the black or red wheats. This fact is thus explained by the writer: in dry climates the leaves dry and die even before maturity is attained, and the function of assimilation, already reduced, is then carried on by the glumes and other green parts of the plant. Now, the red or black pigment, which develops by displacing and replacing the chloro-

(1) See *B. Jan.* 1914, No. 12. (Ed.). (2) PANTANELLI, E., Über Ionenaufnahme. *Jahrbuch f. wiss. Botanik* (Pfeffer-Festschrift), pp. 689-733, 1915. (Author)

phyl granules, causes a still further decrease in assimilation, which results in incomplete development of the caryopses. This fact has led the plant-breeders at the Besen agricultural experiment Station to confine their attention solely to these wheats with *white* ears.

In order to study this interesting phenomenon and to ascertain the conditions, favourable or otherwise, for the accumulation of pigment in the tissues of Gramineae, the writer carried out a series of pot-culture and field experiments, using the following wheats: —

SOFT WHEATS. — 2 pure lines with *red* ears: *Triticum ferrugineum* and *T. militurum*; 2 pure lines with *white* ears: *T. erythrospermum* and *T. lutescens*.

HARD WHEATS. — 1 type with *red* ears: *T. hordeiforme*; 2 types with *black* ears: *T. coarulescens* and *T. abyssinicum*.

It was to be expected that the presence of pigment, by limiting assimilation, would retard the various phases of development and prolong the whole vegetative period. This was actually observed, as is shown by the phenological data given in the following Table:

*Phenological data regarding the various types of wheat employed.*

Types		Sowing	Sprouting	Beginning of earing	Full earing	Beginning of flowering	In full flower	Harvest
Soft wheats:								
Reds	<i>erythrospermum</i> . . .	14 IV	20 IV	8 VI	10 VI	11 VI	15 VI	25 VII
	<i>lutescens</i> . . . . .	<i>id.</i>	<i>id.</i>	7 VI	10 VI	11 VI	12 VI	<i>id.</i>
	<i>ferrugineum</i> . . .	<i>id.</i>	<i>id.</i>	9 VI	12 VI	15 VI	15 IV	<i>id.</i>
	<i>militurum</i> . . . .	<i>id.</i>	<i>id.</i>	10 VI	12 VI	15 VI	17 VI	<i>id.</i>
Hard wheats:								
Blacks	Red: <i>hordeiforme</i> . .	<i>id.</i>	21 IV	8 VI	11 VI	16 VI	18 VI	1 VIII
	<i>coarulescens</i> . . .	<i>id.</i>	<i>id.</i>	9 VI	12 VI	16 VI	18 VI	1 VIII
	<i>abyssinicum</i> . . .	<i>id.</i>	<i>id.</i>	3 VI	7 VI	9 VI	11 VI	19 VII

Although a damp and even rainy season had considerably hastened the development of all the varieties, including the pigmented ones, the characteristic differences between the different types of wheat remained, however, well marked. Compared with the *white* eared wheats, the beardless *red* wheat eared 3 days and flowered 4 days later; the *red* bearded wheats were 1 and 4 days later respectively. These data, obtained by field experiments, were confirmed by the results of pot-culture experiments.

As regards the quantity and quality of the grain harvested, the two series of experiments, both field and pot-culture, showed the superiority of the *white* wheats over the *red* and *black* types.

Those plants and ears, or parts of ears, that faced south-west, pigmented more quickly than plants or ears with a different orientation. Thus the phenomenon of pigmentation seems closely connected with the light, and,

in fact, the duration and intensity of the insolation is at its maximum when the sun is to the south-west. This explanation is confirmed by the results of pot-culture experiments with screens protecting the plants from the sun's rays. These results may be thus summarised :

- 1) The longer the plants are shaded, the less intense is the pigmentation.
- 2) The effect of the screen is more marked if the plants are shaded before flowering ; after that, the effect of the screen (negative effect) is more and more attenuated as the plants approach maturity.
- 3) The effect noticeable on the glume is repeated with the caryopsis, especially with the type *T. abyssinicum* which, when subjected to prolonged shading, finally loses the violet tint characteristic of its seeds.

**25 - The Viability of the Seeds of *Raphanus sativus* L. as Affected by High Temperatures and Water Content** (1). — WAGGONER, H. D., in the *American Journal of Botany*, Vol. IV, No. 5, pp. 299-313, 1 fig., bibliographical index. Lancaster, Pa., May, 1917.

The results of a series of experiments undertaken for the purpose of determining the definite relation between the water content of seeds exposed to high temperatures and their viability. Seeds of 3 varieties of radish (Icicle, Black Spanish Winter, and Crystal Forcing) were used, with an initial water content of from 4 to 71 per cent. In order to heat the seeds, the writer used 3 different methods: 1) in water ; 2) in 300 cc. Florence flasks placed in a wire cage and submerged in a water-bath ; 3) in an oven. Length of exposure, 30 minutes ; temperature, from 50° to 125° C. The seeds were then germinated on plaster of Paris blocks kept in a dark room at about 23° C. (100 seeds were used for each test). For one fortnight, the number of seeds that had germinated every day was observed.

The general resistance to high temperatures of the 3 varieties studied is very similar, therefore it is sufficient to give the data for Icicle (see Table II). An examination of the tables shows that there is a definite relation between the initial water content of seeds and their resistance. Seeds of an initial water content of 71 per cent., 50 per cent. and 45 per cent., are killed off at 60° C. The germinating capacity of the seeds increases with the decrease in the water content and the death point of the sample is raised. As the water content is decreased from 45 to 30 per cent., the lethal temperature shifts from 60° C to 65° C. Air-dried seeds give normal germination after treating at 75° C. and are killed between 95° C. and 100° C. Samples dried until only 4 per cent. of water is present, give a normal germination at 100° C., and are killed between 123° C. and 125° C.

In the check, the maximum daily per cent. of germination (45 per cent.) occurred on the 2nd. day, while of the treated seeds, those which had been exposed to temperatures below the critical temperature, gave highest percentages on the 3rd., or 4th. day (see Table II). The retardation becomes greater as the injury due to the treatment becomes more marked.

In determining the lethal temperatures for seeds of similar kinds, previous investigators had obtained very different results. This is probably

(1) On the subject of the effect of high temperatures on the vitality of seeds, see also R. June, 1917, No. 533 and R. September 1917, No. 891. (Ed)

due to the fact that, in these experiments, no attention was paid to the initial water content which, as has just been shown, causes the lethal temperature to vary within very large limits. The data obtained by the investigator depended upon the method used for heating the seeds. With an initial water content of 19 per cent., the lethal temperature was 65° C. for seeds heated in water; 85° C. for those heated in flasks; 105° C. for the seeds heated in the oven (See Table III).

Seeds heated in water absorb, during the experiment, a considerable amount of moisture, as is shown by the increase in weight. Seeds heated in flasks lose in weight for the first 10 minutes, after which the weight remains constant; seeds heated in the oven lose weight throughout the duration of the experiment, and it is owing to this loss of water, that they acquire greater powers of resisting the effect of high temperatures.

TABLE I. — *Germination Percentages in the Icicle variety.*

Initial Water Content	Temperatures																Unheated Seed
	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	110°	115°	120°	125°	
Germination Percentages :																	
71 %	80	45	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87
50 %	83	50	—	—	—	—	—	—	—	—	—	—	—	—	—	—	88
45 %	84	69	—	—	—	—	—	—	—	—	—	—	—	—	—	—	87
38 %	82	72	14	—	—	—	—	—	—	—	—	—	—	—	—	—	89
30 %	—	74	25	—	—	—	—	—	—	—	—	—	—	—	—	—	90
23 %	—	74	38	1	—	—	—	—	—	—	—	—	—	—	—	—	90
18 %	—	78	66	38	11	—	—	—	—	—	—	—	—	—	—	—	88
14 %	—	85	74	69	63	26	18	6	—	—	—	—	—	—	—	—	89
9 %	—	88	82	85	74	54	36	15	10	—	—	—	—	—	—	—	90
4 %	—	—	86	91	90	91	82	79	76	40	—	—	—	—	—	—	89
2.3 %	—	—	—	—	—	89	88	87	99	87	80	72	57	5	—	—	88
1.3 %	—	—	—	—	—	—	90	89	88	82	73	67	32	4	—	—	89
0.8 %	—	—	—	—	—	—	—	—	89	88	85	76	62	32	—	—	80
0.4 %	—	—	—	—	—	—	—	—	—	89	86	78	64	28	14	—	90

TABLE II. — *Retardation in Germination caused by Varying Water Content when Heating at 80° C. for 30 minutes.*

	Initial Water Content				Unheated Seeds
	4 %	9 %	14 %	18 %	
	Germination Percentages :				
1st day . . . . .	6 %	0.6 %	0 %	0 %	30 %
2nd day . . . . .	21	5.4	0	0	45
3rd day . . . . .	35	17.0	7.4	0	14
4th day . . . . .	17	24.2	11.0	0	3
5th day . . . . .	3	10.0	6.0	0	2
6th day . . . . .	1	3.6	2.2	0	1
7th day . . . . .	0	0	0.4	6	0
Total Percentage . . .	83 %	68.8 %	27.0 %	0 %	90 %



TABLE III — *The Effect of Different Methods of Heating Upon the Germination of Seeds.*

	Temperatures													
	45°	50°	55°	60°	65°	70°	75°	80°	85°	90°	95°	100°	105°	
	Germination Percentages:													
Wheat heated in water . . . . .	88	80	58	2	6	0	—	—	—	—	—	—	—	
Wheat heated in flasks . . . . .	—	89	87	81	66	18	9	0	0	—	—	—	—	
Wheat heated in oven . . . . .	—	—	—	—	—	—	89	88	84	76	60	6	0	
Checks, untreated . . . . .	88	90	89	88	89	91	90	90	89	88	90	90	89	

26 — **The Action of Overhead Electric Discharges on Oats and Clover.** — See No. 10 of this Review.

27 — **Reversible Transformability of Allelomorphs in Rice in Japan.** — TERA0, H. (Imperial Agricultural Experiment Station, Tokyo, Japan), in *The American Naturalist*, Vol. II, No. 611, pp. 690-698, VII Tables. New York, 1917.

PLANT  
BREEDING

In certain pedigree cultures of the rice plant, at the above-mentioned Station, the writer observed in 1912, families containing a number of sterile plants besides ordinary fertile plants. The former may be divided into 3 groups:

- 1) Forms yielding no seed.
- 2) Forms yielding a small number of seeds.
- 3) Mosaic forms with higher fertility.

These anomalies occurred in 2 families, A and B, which were derived from 2 plants each belonging to a different variety of rice. Tables I and II summarise the observations made on these families in 1912 and 1913.

From these observations it would appear that sterility, S, behaves as a simple recessive to fertility, F, which is a dominant. F and S form a pair of allelomorphs, and the seeds produced, by partial fertility, by the sterile plants, give rise to families composed of fertile and sterile individuals in the Mendelian ratio 3:1.

TABLE I. — *The Segregating Families A and B, in 1912.*

Family	Partial fertility of sterile plants								
	Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plants	Ratio 3 : 1		Total number of spikelets	Fertile spikelets	
					Fertile individual- dominants	Sterile individual- recessives		Number	Percentage
A . . . . .	36	13	49	26.53 %	2.94	1.06	9 000	2	0.02 %
B . . . . .	105	25	130	19.23 %	3.23	0.77	14 941	434	2.90 %

TABLE II. — *The Families Derived from the Families A and B in 1913.*1) *The Progeny of the Fertile Plants.*

Families in 1912	Number of families in 1913			Ratio 1:2		Composition of partially fertile families in 1913			
	Com- posed of uniformly fertile plants	Compos- ed of fertile plants and of sterile plants	Total	Uni- formly fertile plants	Partially fertile plants	Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plants
A . . . . .	10	22	32	0.94	2.06	1,068	346	1,414	24.46 %
B . . . . .	41	64	105	1.17	1.83	4,874	1,301	6,175	21.06 %

2) *The Progeny of the seeds on the sterile plants.*

Families in 1912	Number of families in 1913	Composition of families in 1913			
		Number of fertile plants	Number of sterile plants	Total number of plants	Percentage of sterile plants
A . . . . .	2	2	0	2	0.00 %
B . . . . .	24	401	115	516	22.29 %

In family A, which shows an exceedingly slight fertility (0.02 per cent.) of sterile plants, the segregation ratio in the offspring derived from fertile individuals, in 1913, is quite close to expectation. On the other hand, in family B, which shows a considerably higher grade of partial fecundity of sterile plants (2.90 per cent.), the progeny of the fertile (dominant) individuals exhibit considerable deviations from the expected segregation ratio, the fertile plants being more numerous.

The writer explains this phenomenon as follows: the dominant and recessive types concerned are assumed to be transformed by certain unknown causes into the other allelomorph. In the cases observed by the writer, the recessive allelomorph S, which appeared in 1912 in families A and B may have originated in the preceding generation (1911) by the transformation of the dominant allelomorph, F. This recessive state, however, of the hereditary substance has a tendency to revert to the original dominant state, and this reversion is especially likely to occur in the vegetative cells. Consequently, in recessive homozygotes, SS, the reversion will generally produce heterozygotic cells FS or SF, capable of being changed into homozygotic dominants FF. The heterozygotic cells thus formed will give rise to partial fertility in otherwise sterile plants, and cause the excess in the proportion of dominant individuals in plants arising from the seeds produced by the partial fertility of the sterile plants of family B. Finally, it may be assumed that, between families A and B, there exists a difference in the reverting tendency of the recessive and dominant characters; this tendency would be strongest

in family *B*, where the number of sterile plants in the process of segregation is, on an average, 4 per cent. less than was theoretically expected.

There are also cases where the transformation of the allelomorphs takes place in the reverse direction: from dominants to recessives. Thus, in the descendants of families which had proved to be constantly fertile, the occurrence of partially sterile families was observed. On the other hand, a constant tendency of the dominant allelomorph to be transformed into the recessive allelomorph was observed in certain strains; thus, in 1913, in certain partially sterile families there was a particularly high excess of recessive individuals.

The fertile spikelets of sterile plants are generally scattered at random over the panicle, and each fertile spikelet may be regarded as representing a separate case of reversion. In mosaic forms, which show higher fertility and are of rare occurrence, the reversion may have taken place in earlier stages of plant development, affecting more or less extensive groups of cells which gave rise to the fertile portions, such as groups of spikelets, half a panicle, or even a whole panicle, each group, however, constituting a single case of reversion. Consequently, when the count of fertile spikelets is made with only the first type of sterile plants, a more correct value for the frequency of reversion may be obtained. The result of such a count on 902 panicles containing 93 635 spikelets is 1858 fertile spikelets *i. e.* 1.98 per cent. of the total number of spikelets.

CONCLUSIONS. — The allelomorphs concerned in this investigation are probably subject to reversible transformations, of which the direction and frequency may be practically constant in a certain strain, but may be different in different strains.

As regards the conception of dominance and recessiveness, BATESON'S theory of "presence and absence of factors" is sometimes understood in the sense that the dominant allelomorph is regarded as due to the real presence of an hereditary material unit which is absent in the recessive allelomorph. Such a conception is not in full accordance with the idea of the reversible transformability of allelomorphs as described in this investigation.

This reversible transformability of allelomorphs is better explained by supposing that the dominant and recessive allelomorphs represent 2 alternative conditions, or phases, of a single hereditary substance somewhat resembling the chemical conception of polymerization.

28 — **Selection of Sorghum in Queensland, Australia.** — BROOKS, G. B., in *Queensland Agricultural Journal*, Vol. VIII, Pt. 4, pp. 194-197 + 1 plate. Brisbane, October, 1917.

Many varieties of both fodder and grain sorghums are cultivated in Queensland as they are well suited to this country on account of their resistance to drought.

Results are given of selection experiments designed to increase the grain yield, results which exceeded all expectation. Thus, for the fodder varieties, the grain production rose from 25.6 bushels per acre in 1916 to 52 bushels in 1917, and, for the grain varieties, from 50.8 bushels to 70.2

bushels. The average weights of the ears of the different varieties for 1916 and 1917 are given in the appended table :

*Weight of the ears of the different varieties of sorghum in 1916 and 1917.*

Variety	1916	1917	Heaviest head in 1917 selection
	Oz.	Oz.	Oz.
Crossbred, No. 1 Selection . . . . .	7.0	11.8	13.0
» No. 2 Selection . . . . .	—	10.0	10.5
Giant Honduras . . . . .	—	6.8	8.5
Cream Milo . . . . .	4.8	5.9	7.5
Feterita (Sudan Dhoura) . . . . .	4.0	5.6	6.8
Planters' Friend . . . . .	3.0	5.1	6.8
Standard Milo . . . . .	4.2	4.9	5.5
B. H. Kaffir . . . . .	3.4	4.7	6.8
Dwarf Milo . . . . .	4.2	4.9	5.0
Shantung Dwarf . . . . .	3.2	3.6	4.0
Saccharatum . . . . .	2.5	2.9	4.3
Amber . . . . .	1.2	1.8	2.0

The crossbreds show an absolute superiority in the weight of the ear, which gives good promise for the final results of the selection work. Certain undesirable characters, such as astringent grain and late maturing, will be eliminated later by suitable crossings.

It should be noted that the open seed varieties are less liable to attack from the maize caterpillar than the compact headed ones.

29 - **Researches on the 35 Factors Determining the Various Characters of the Genus *Pisum*, in the United States.**—WHITE, ORLAND E. (Curator of Plant Breeding, Brooklyn Botanic Garden), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 166-190, IV + 27 tables, bibliographical index of 39 publications. Washington, 1917.

Experimental researches on the genetic factors of *Pisum* carried out by a method of rigorous investigation at the Brooklyn Botanic Garden, New York, and completed by a critical examination of the works and experiments of previous writers.

The article in question is divided into 4 parts :

- I. — An analytic list of the 35 factors hitherto isolated and studied.
- II. — The effect of external agents upon the expression of these factors.
- III. — Factors which are transmitted independently of one another.
- IV. — Linkage of factors.

I. — **GENETIC OR DETERMINING FACTORS.** — There are 35 genetic factors which suffice to explain all the specific differences between the numerous species and varieties of the genus *Pisum*. These factors influence their : habit of growth ; time of flowering ; colour of stems, leaves and flowers ; colour of the cotyledons and of the seed-coats ; colour and character of the pods and seeds.

1) *Mode of growth* : T = tall, robust plants, large number of internodes ; (Le) = long internodes ; (Fa) = axillary flowers, round stems, regular

phyllotaxy; (Fn) = 1 or 2 flowers per peduncle; (Tl) = leaves with tendrils; (Lf) = late flowering; (Ef) = early flowering.

2) *Colour of flowers*: — A = salmon-pink or rose (B gives purple colour when combined with A).

3) *Colour of stem and leaves*: — The factors C and D give red colour to leaf axil and stem (with the addition of A) and a purple colour with the addition of B; the factor O produces green foliage, stems and pods; (Bl) coupled with W gives a glaucous tint.

4) *Colour of cotyledons*: — G, green cotyledon pigment, is made paler by presence of I.

5) *Colour of seed-coats*: (Gc) [A] produces yellowish green to greyish-brown seed coat, which colour is brightened or inhibited by H and becomes dark-brown in the presence of I; U = dark self-coloured seed coat; (Pl) = black-eyed pattern; E (A), with F and B, gives purple dottings which, in the absence of B, gives reddish dots; W = brown or maple mottling; N = violet eyes.

6) *Colour of pods*: — P<sub>1</sub> + P<sub>2</sub> gives purple pods; (Gp) = green.

7) *Seed characters*: — R produces smooth round seeds with simple, oval starch grains, low water content and excellent powers of germination under unfavourable weather conditions; L<sub>1</sub> (A) + L<sub>2</sub> give indent peas; S produces pods with separate, or free seeds.

8) *Pod characters*: — (Bt) = pods with blunt apex; P + V gives parchmented, smooth pods, which are not edible.

II — MODIFICATION OF THE EXPRESSION OF PISUM FACTORS BY EXTERNAL AGENTS. — The absence of (Fa) brings about intense fasciation of the stems, but this may be produced, even in the presence of (Fa), by damp weather and lack of sufficient sunlight.

Peas may be classified into 3 general types as regards height.

(1) dwarfs, with from 8 to 15 short internodes;

(2) half-dwarfs, with 10 to 18 long internodes, or 20 to 30 short ones;

(3) tall, with 35 to 60 well-developed internodes.

These differences depend upon 2 factors (Le) and T, and they are often modified by disease and high temperature, etc., which produce cases of dwarfs, even in the presence of the 2 factors (Le) and T.

The expression of the factor O may be suppressed by lack of sufficient salts (especially potash) in the soil. In this case, the aerial parts are of a sickly yellow colour.

Prolonged damp or rainy weather, even in the presence of the 2 factors A and B, change the purple colour to pink, or in extreme cases, to white.

The anthocyanin pigment of the seed-coat pattern, brought about by the factors E and F, is soluble in water and may be washed out in rainy weather, even in the presence of E and F.

Under greenhouse conditions, where the temperature and humidity are constant, the above-mentioned fluctuations do not occur, which allows of the different genetic factors being more distinctly individualised. Once the presence of a certain factor has been determined in a given pure line,

the absence or hindrance of the expression of this factor may be attributed to external agents.

III. — THE NUMBER OF INDEPENDENT FACTORS. — The cytological studies hitherto made show that there are 7 pairs of chromosomes in the species of *Pisum* investigated. According to the chromosome theory each determinant is localised at a single fixed point of a chromosome which is always the same.

Therefore, in the case of the genus *Pisum*, the number of characters, or groups of characters, which are wholly independent of one another, in the processes of separation and recombination, cannot exceed 7.

The writer carefully analyses the  $F_2$  ratios from crosses involving the presence and absence of 8 factors: — A; B; (Fa); I; (Le); G; R; (Ti), 2 of which [R and (Ti)] are linked, that is to say, localised in the same chromosome. Each factor has been tested out in crosses involving *all its possible combinations* with the other 6. Data involving many thousand  $F_2$  generation progeny, indicate that the number of independent factors is 7, namely: A; B; (Fa); I; (Le); G; R.

IV. — LINKAGE IN PISUM. — Two or more factors contained in the same chromosome are naturally united in such a manner that one character is always associated with the other corresponding character.

The writer has collected data concerning the following linked groups:

- 1) (Bf) S = pods with seeds separate or free; glaucous foliage stems and pods with "bloom".
- 2) A (Lf) = Salmon - pink or rose - coloured flowers; late flowering.
- 3) GO = Green cotyledons; green (non-glaucous) stems, leaves and pods.
- 4) A C E (Gc) Lr = in this group, the factors are so closely associated, that they may be considered as the expression of one single factor A.

In the genus *Pisum* the length of the chromosomes facilitates the phenomenon of crossing-over (I) and renders still more difficult the determination of independent characters, and of groups of characters based on the chromosome theory.

The writer has, however, been able to overcome this difficulty by means of multiplying the control experiments, so that the data obtained do not only permit of the determination of the gametic formula of any species, variety, or kind, of *Pisum*, but also make it possible to predict the results of any crossing.

(1) MORGAN and his collaborators have studied the interesting phenomenon of the reciprocal exchange of elements between 2 chromosomes, which phenomenon is called "crossing-over". Each chromosome may be regarded as the sum of a large number of linear segments, each of which would represent a genetic factor. If, for instance, in the case of 2 chromosomes of equal length and composed of an equal number of segments, these segments on touching one other should be exchanged, the phenomenon of "crossing over" would be produced and occur the more frequently the longer the chromosome and the less completely the elements of a series are united. Cf MULLER II, the Mechanism of Crossing-Over, in *The American Naturalist*, Vol 50, No 592, pp 193-221, 5 figs.; No. 593, pp. 284-305, 4 figs.; No. 594, pp. 350-366; No. 595, pp. 421-434, 4 figs. Lancaster, Pa., 1916. (Ed.)

30 - **The Indirect Effects of Certain Selections in Breeding Indian Corn.** — RIETZ, H. L. (Professor of Mathematical Statistics and Statistician) and SMITH L. H. (Chief in Plant Breeding, Illinois Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 105-146, 5 Tables, 24 Diagrams, Washington, 1917..

As the result of individual selection experiments extending over a considerable period, the Illinois Agricultural Experiment Station has succeeded in creating from the same stock, 4 strains of maize which differ in their protein and oil content.

- 1) Maize with high protein content ("high-protein strain")
- 2) Maize with low protein content ("low-protein strain")
- 3) Maize rich in oil ("high-oil strain")
- 4) Maize poor in oil ("low-oil strain")

The article analysed gives the results of a statistico-experimental study undertaken in order to determine if chemical selection has indirect effects of an anatomical nature, or in other words, if the 4 above-mentioned strains differ, not only in chemical composition, but also in other constant biometrical values. The physical characters treated of are: 1) length of ears; 2) circumference of ears; 3) weight of ears; 4) number of rows of kernels on ears. The physical characters determined in 1905 (see Table 1), allow of real specific differences being established, but the observations of one year are not sufficient, for it may only be a question of fluctuations, that is to say, of differences and ratios that are not fixed and constant, but which vary from one year to another. To avoid this difficulty, the writers continued their work of selection, determination and classification for 11 successive generations of maize (1905-1915). The following is a summary of the most important results which they obtained.

**LENGTH OF EAR.** — In 1905, the length of ear was significantly different in the 4 strains. The smallest difference that existed was  $0.27 \pm 0.056$ ; this is about 5 times the probable error. We have to do here, therefore, with a well-defined character which persisted throughout the observation period in spite of different conditions of soil and climate.

**CIRCUMFERENCE OF THE EAR.** — The strains differed from one another to a greater extent and more constantly in the circumference of the ears than in the length. The types rich in protein had, as a rule, the most slender ears, while thicker ears were found in the strains which had a low oil content. The difference between the low-oil and the low-protein strains, although slight, remained constant throughout the period of observation.

**WEIGHT OF EARS.** — As in the two preceding cases, the high-protein and the high-oil strains had lighter (*i. e.*, shorter and more slender) ears than the low-protein or low-oil. This difference remained constant during the whole period of observation.

**NUMBER OF ROWS OF KERNELS ON EAR.** — In 1915 there was a significant difference in the number of rows of kernels on the ears; this difference remained constant during the succeeding generations. As this character is determined by inherent tendencies, and is less susceptible to external or environmental influence than the other characters considered, we should expect smaller fluctuations.

TABLE I — *Biometric Values obtained in 1905.*

Types of maize	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Mean number of rows of kernels on ear
High-protein . . . . .	$7.21 \pm 0.04$	$5.71 \pm 0.01$	$7.53 \pm 0.04$	$13.72 \pm 0.03$
Low-protein . . . . .	$7.80 \pm 0.04$	$6.51 \pm 0.02$	$9.66 \pm 0.10$	$14.71 \pm 0.06$
High-oil . . . . .	$6.87 \pm 0.04$	$6.05 \pm 0.01$	$7.79 \pm 0.07$	$15.65 \pm 0.06$
Low oil . . . . .	$7.48 \pm 0.04$	$6.65 \pm 0.02$	$9.84 \pm 0.05$	$12.80 \pm 0.05$

CONCLUSIONS. — The selection of chemical characters influences certain anatomical characters and leads to a progressive differentiation in length of ear; circumference of ear; mean weight of ear; number of rows of kernels per ear.

These two last characters present, in the case of the 4 strains studied, values and differences which remain constant even when the climatic and soil conditions vary.

There is an interesting correlation between the dimensions and weight of the ear on the one hand, and the height of the insertion of the ear on the stalk, on the other. There are 2 distinct cases :

1) In plants with 2 ears, the upper ear was, on an average, larger and heavier than the lower one. In 1909 the values given in Table II were found.

TABLE II. — *Biometric Values in Plants with 2 Ears in 1909.*

	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Number of rows of kernels per ear
Upper ear . . . . .	$8.325 \pm 0.062$	$5.970 \pm 0.028$	$7.69 \pm 0.12$	$16.76 \pm 0.16$
Lower ear . . . . .	$6.512 \pm 0.097$	$5.373 \pm 0.036$	$4.51 \pm 0.14$	$16.32 \pm 0.18$

These differences remained constant throughout the whole period of observation.

2) In plants with a single ear, low-ear strains and high-ear strains were

TABLE III. — *Biometric Values in Plants with One Row of Ears in 1908.*

	Mean length of ear; inches	Mean circumference of ear; inches	Mean weight of ear; ounces	Number of rows of kernels per ear
High-ear plants . . . . .	$6.380 \pm 0.039$	$6.148 \pm 0.018$	$6.980 \pm 0.080$	$18.09 \pm 0.091$
Low-ear „ . . . . .	$6.700 \pm 0.035$	$6.540 \pm 0.020$	$7.795 \pm 0.080$	$18.96 \pm 0.088$



to be distinguished. The ears of the first were, as a rule, longer, thicker and heavier than those of the second, and also bore more rows of kernels. In 1908 the values given in Table III were obtained.

The differences observed in 1908 remained constant for 6 consecutive years.

31 — **"Quality", a New Variety of Strawberry.** — ANTHONY, R. D., in the *Journal of Heredity*, Vol. VIII, No. 11, p. 509. Washington, November, 1917.

From the cross of the Johnson Late Strawberry with Sharpless made in 1889-90 by HUNN, about 400 hybrids were obtained. Of these, only one seemed of value and was named after its originator. In 1898, the Hunn variety, pollinated by Atlantic, gave many hybrids, of which only one survived and was called "Quality". In 1907, seedlings of this plant were obtained by self-pollination. Two of these were retained for a study of sex, one of which was perfect (with both stamens and pistils), the other imperfect (with pistils only). The perfect plant was self-pollinated and gave seedlings lacking in vigour, of low yield and with small berries. The imperfect plant, pollinated by the perfect one, gave large, very vigorous and extremely productive plants with fruit above the average in size. By propagating this variety a very valuable commercial type might be obtained.

32 — **Hybridisation Experiments: Between Species of *Dolichos*; Between Species of *Phaseolus*; Between the Genera *Dolichos* and *Phaseolus*.** — See No. 51 of this Review.

33 — **The Selection of Cotton for Resistance to Black Scale, in St. Vincent, East Indies.** — See No. 117 of this Review.

34 — **Results of the Enquiry of the Office of Agricultural Information of the French Ministry of Agriculture on Manitoba Wheat (1).** — *Feuille d'informations du Ministère de l'Agriculture*, Year 22, No. 45, p. 10. Paris, Novembre 6, 1917.

CEREAL  
AND PULSE  
CROPS

The Manitoba wheat distributed in the spring of 1917 among the different departments was grown under very varying conditions. The results of the enquiry made by the Office of Agricultural Information lead to the following conclusions:

**Soil.** — Manitoba wheat does well in all wheat soils, that is to say, medium loams, calcareous loams and rapidly drying silt soils. As a rule it does not do well in calcareous soils or in heavy clay. Nevertheless, in the limestone districts of the Meuse department satisfactory results were obtained. As a general rule, however, healthy soils, sufficiently rich in water at the time of sowing are to be recommended.

**Climate.** — Manitoba wheat appears to be very resistant to drought; scorching was reported from the Ain department only. It does well in the mountains, at a height of 5 250 feet in the Upper Alps and 2 300 feet in Upper Savoy.

**Cultural Methods.** — *Preparation of the soil.* — Manitoba wheat requires a very clean tilth in order to give good results. In spite of its rapid

(1) For the experiments on Manitoba wheat see R. April, 1917, No. 326 and November, 1917, No. 1017. (Ed.).

growth it easily becomes weedy. Information obtained from all over France shows that the yield is satisfactory only if the ground is thoroughly prepared by two autumn ploughings and shallow cultivation in spring, before sowing.

*Manuring.* — Farmyard manure mixed with superphosphates seems to have given better results than chemical fertilisers alone.

*Sowing.* — Careful sorting of Manitoba wheat seed appears indispensable; the seed used in 1916 included at least four varieties, two of which were bearded. The small seeds only gave medium results. All directors of agricultural departments recommend close sowing in perfectly healthy and thoroughly drained soil. This condition explains the differences noticed with regard to the dates considered the best for sowing. The departments of Côte-d'Or, Drôme, Gard, Rhone, Manche, Meuse, Morbihan, Vienne and Gironde, advise sowing before the end of March. The February sowing in Upper-Vienne did exceptionally well, but the results obtained with late sowing were very good in the departments of Eure-et-Loire, Orne, Eure, Calvados, Indre, Nièvre, Pas-de-Calais, Sarthe. In the departments of Eure and Orne it was possible to sow as late as May 15th.

*Resistance to Rust.* — The enquiry showed clearly that Manitoba wheat is very resistant to rust. In the districts in which rust was rife, this wheat was either completely immune or much less attacked than the local varieties.

*General Results.* — The results were mediocre in Ariège, Aude, Dordogne, Doubs, Finisterre, Meurthe-et-Moselle, Morbihan, Upper Pyrenees, Lower Pyrenees, Seine-et-Oise and Tarn-et-Garonne. In all the other departments the results were good or very good, and the yields better than those of the local spring varieties, though not so high as those of the local autumn varieties.

35 — **Results of the Cultivation of the Carlotta Strampelli Hybrid Wheat in Rice Fields in Italy** (1). — MARCARELLI, B., in *Il Giornale di Riscicoltura*, Year 7, No. 17, pp. 213-215. Vercelli, September 15, 1917.

In 1914-1915, and again, in 1915-1916, the Vercelli Rice-growing Station carried out experiments in the cultivation of Carlotta Strampelli wheat. During the second year, the effect of the date of sowing and different quantities of seed were tested. Sowing carried out on October 15th. with 75.83, 89.21 and 98.13 lbs. of seed per acre, gave 24.82, 25.14 and 25.86 cwt. per acre; that carried out on October 25th. with the same quantity of seed gave 23.54, 24.50 and 24.74 cwt. per acre, and that of November 4th. gave 19.24, 19.16 and 17.82 cwt. per acre. The best harvests, then, were obtained with the earliest and thickest sowing. Cologne Veneta wheat, cultivated under the same conditions, yielded from 18-19 cwts. per acre (*Il Giornale di Riscicoltura*, Year 1, No. 19, pp. 291-296, October 15th., 1916).

In view of these good results, the Rice-growing Station provided farmers with a certain quantity of Carlotta Strampelli wheat to be grown ex-

(1) See also B. 1915, No. 167; R., 1916, No. 1175. (Ed.)

perimentally and compared with the varieties usually cultivated by them. Five farmers obtained the following results (very unfavourable year): —

1) Carlotta Strampelli	8.26 cwt. per acre	.	.	.	Gentil rosso	{	7.16 cwt. per acre
					Hybride inversable		
2) Carlotta Strampelli	10.24	"	"	"	Cologna Veneta	{	8.66 " " "
					Rieti		
3) Carlotta Strampelli	15.58	"	"	"	Cologna Veneta	{	12.08 " " "
					Varesotto		
4) Carlotta Strampelli	11.94	"	"	"	The other varieties gave a rather lower yield.		
5) Carlotta Strampelli	16.10	"	"	"	Cologna Veneta		13.12 cwt. per acre.

In all cases the Carlotta Strampelli variety showed marked resistance to lodging, great vigour and slighter encroachment of weeds.

" With a few exceptions the wheats now grown in the Vercelli district are not well adapted to the conditions of soil and atmospheric moisture, to the fertility of many soils. The greater part were introduced from dry, or only partially irrigated districts, without special attention being paid to the characters of the varieties and their cultural requirements. Many have a limited proportion of culms and leaves, and they ripen too early to profit by the local climatic conditions, without having on that account a greater resistance to lodging and a good production. The varieties which, in rice fields, give a high yield, are those with tall, strong straw, with large leaves, a rapid growth from the beginning, so as to limit as much as possible the development of weeds, a rather late ripening period, and a large number of grains in proportion to the length of the rachis. In these respects Carlotta Strampelli wheat seems preferable to all others ".

**36 — Trials of Different Methods for the Cultivation of Winter Wheat, in the Great Plains Area, U. S. A. —** See No. 11 of this Review.

**37 — Rye-Growing in Uncultivated Rice-Fields ; in Italy. —** MARCARELLI, B., in *Il Giornale di Riscoltura*, Year VII, No. 17, pp. 210-213. Vercelli, September 15, 1917.

Rye-growing in rice-fields, without any previous preparation of the soil, can be carried out according to the rules recently suggested by Prof. NOVELLI for sowing wheat on uncultivated rice-land.

For this purpose the land should be wet and light, not too fertile, and not likely to pay for growing wheat. The rye is sown from mid-September to the end of October, before the rice harvest and just before turning the water away from the rice-field, taking care that the soil be quite free from water two days after sowing.

Where water is available, the rye may be sown on the rice stubble, previously inundating the ground, for, to obtain the best results with this method, the rye seeds must be sown on inundated ground, to obtain the greatest adherence of the grains to the muddy ground, followed by prompt germination. In this case, and if calcium cyanamide is available, a first nitrogenous manuring of 0.8 cwt. per acre may be given some days before admitting the water. In any case, from 18 to 23 lbs. more seed per acre than usual have to be sown to assure abundant vegetation and to make up

for the inevitable loss that occurs during germination and the young stages of the plant.

Immediately after the rice harvest, all the irrigating canals must be well looked after, deepening them a few inches and making new ones if there are not sufficient present. The dikes should be destroyed, and if mineral fertilisers are available, 62 to 72 lbs. of sulphate of ammonia and 1.6 to 2.4 cwt. of superphosphate should be given per acre, this is, if calcium cyanamide has not already been applied.

At the end of winter, before the rye has commenced its new growth, a slight harrowing should be given so as to break up and bury the stubble, and provide a good surface tilth. During the later stages of growth, no other attention need be given, save that the drainage ditches should be maintained in good order and a nitrogenous manuring applied if the cereal has suffered from the winter.

After the rye is harvested, the ground can be used for rice by employing transplanting, or, after sowing a cover crop of clover or some other leguminous plant in the beginning of March, a good cut of fodder may be obtained the same year.

The writer considers the advantage of substituting wheat by rye under the present exceptional conditions, when it is necessary to produce the greatest possible quantity of cereals. He further adds :

In many rice-growing districts of Piedmont, 1 acre of ground only produces 15 to 18 bushels of wheat, while it produces 22 to 24 bushels of rye. When there is a shortage of phosphatic manures and labour for cultivating the crop, rye is indicated as it requires less attention and is more hardy, quickly covering the ground and smothering weeds. This latter quality give the result that, when rice follows rye, the former requires less cleaning.

It should be remembered that rye is harvested 20 to 25 days before wheat, that is to say, at the period when the provision of wheat and, in general, cereals used for bread making, is the most required

#### FIBRE CROPS

38 - Various Fibres Examined at the Imperial Institute, London. — See No. 5 of this *Review*.

39 - Flax Cultivation Trials in Egypt. — See No. 5 of this *Review*.

40 - Cotton Growing in Australia. — See No. 5 of this *Review*.

41 - New Paper-Making Materials Examined at the Imperial Institute, London. — See No. 5 of this *Review*.

42 - *Ricinodendron Rautaneii*, An Oil-Yielding Euphorbiaceous Plant of the South-African Veldt. — See No. 5 of this *Review*.

43 - New Oil Seeds from American Palms. — See No. 5 of this *Review*.

[37-43]

44 — **The Indigenous Tan and Dye-Producing Plants of New Zealand.** — ASTON, B. C., in *The Journal of Agriculture*, Vol. XV, No. 2, pp. 55-62; No. 3, pp. 117-128. Wellington, August 20 and September 20, 1917.

The writer reviews the literature of the subject and draws attention to the fact that the ancient Maoris extracted the vegetable dyes, which they used for dyeing their garments, from the following trees and shrubs:—

Pure-black colours were obtained from the hinau small tree (*Elaeocarpus dentatus*) and the pokaka (*E. Hookerianus*), and to a less extent from the towai or beech trees (*Nothofagus fusca* and *N. Menziesii*) the tawhero-tree (*Weinmannia racemosa* and *W. sylvicola*) and hange-hange shrub (*Geniostoma ligustrifolium*).

Blue-black colours were obtained from the tutu or turakihi shrubs (*Coriaria ruscifolia*) and the mako-shrub (*Aristotelia racemosa*).

Red-brown colours were yielded by the toatoa or tanekaha tree (*Phyllocladus trichomanoides*) and makamaka-shrub (*Ackama rosaeifolia*).

Yellow, golden or brownish-yellow colours were got from the karamu-shrub (*Coprosoma* sp., probably *C. lucida* or *C. robusta*), raurekau-shrub (*Coprosoma grandifolia*) and puriri-tree (*Vitex littoralis*).

A blue colour was said to have been obtained from the whakou-shrub, or small tree (*Eugenia mairi*).

It is significant that, in the majority of cases, the colouring of the fibres was effected by the aid of plants extremely rich in tannin, or closely allied compounds.

The following data are given as regards modern experience and research in New Zealand tannins and dyes:—

**PLANTS FURNISHING DYES.** — *Aristotelia racemosa* (makomako, or wineberry). The bark supplies a blue-black dye.

*Tetragonia trigyna* (New Zealand spinach) yields a purple fluid used for ink. The fruit of *Schefflera digitata* and the juice of the root of *Phoridium* were also used for this purpose as well as for tanning.

*Coprosoma* spp. This genus of *Rubiaceae* (which includes 40 species), is restricted in habitat to Australasia, the Pacific Islands, New Guinea and Borneo. Many of its representatives are amongst the commonest and most widely distributed native shrubs. Their bark, and especially the cortex of the root, are of considerable tinctorial power, as in the case of *Coprosoma grandifolia* (orange-yellow); *C. linariifolia* (bright-yellow), *C. lucida*; *C. rotundifolia*; *C. rhamnoides*; *C. foetidissima*; *C. microcarpa*.

The preliminary tests of the writer have shown that there is reason to believe that closely similar, if not identical, dyes to those of madder (*Rubia tinctoria*) are to be obtained from *Coprosoma* roots, which have the economic merit of being larger than those of the former plant.

*Vitex lucens* (syn. *V. littoralis*) (puriri), furnishes, with various mordants, different yellow and brown tones. It has been suggested as a source of khaki dye for military material. Some of the lichens used for dyeing purposes in Scotland are also to be found in New Zealand: *Parmelia caperata*, *P. saxatilis*, *P. parietina*, *P. perlata*, *Lecanora tartarea*.

**PLANTS FURNISHING TANNINS.** — *Elaeocarpus dentatus*, (Hinau); the bark

contains from 19 to 20 per cent, of tannin; it is also used for dyeing.

*Elaeocarpus Hookerianus* (pokaka). The bark contains tannin. *Coriaria ruscifolia* (syn. *C. sarmentosa*) contains tannin in all parts of the plant.

*Ackama rosaeifolia* (Makamaka) — *Weinmannia sylvicola* (Tawhero or Towai), *W. racemosa* (Towai or Tawero in the north, Kamaki in the south Island) — *Eugenia maire* (Whakou or Wawhakou or Kiwaka), with 16.7 per cent. of tannin in the bark — *E. Smithii* with 10.7 per cent. — *Puschia excorticata* with 5.3 per cent — *Metrosideros* spp. (with 15 to 18.35 per cent of tannin in its bark). — *Fagus* spp. (syn. *Nothofagus*) — *Podocarpus spicata* (Matai or Black Pine) — *Dacrydium cupressinum* (red pine or Kimu) — *Phyllocladus trichomanoides* (celery-topped pine = Tanekaha, Toatoa) with 28.66 per cent of tannin in the bark — *Phyllocladus glauca* (Toatoa) and *Ph. Alpinus* (Mountain Toatoa) with tannin in its bark and phyllodia, and perhaps toi (Cordylina indivisa), supply a large amount of tannin.

RUBBER,  
GUM AND RESIN  
PLANTS.  
SUGAR CROPS

45 — *Melanorrhoea usitata*, a Plant from Burma and Siam Producing a Black Lacquer. — See No. 5 of this Review.

46 — Sugar Cane Cultivation and the Manufacture of Sugar in the Republic of Salvador, Central America. — DOWNIE, HARRY A., in *The Louisiana Planter*, Vol. LVIV, No. 18, pp. 281-286. New Orleans, November 3, 1917

I. — CULTIVATION. — A description is first given of the methods usually adopted in Salvador: the cane is planted between rows of maize, and all work is done by hand. The author then describes the methods he adopted at La Labor de Duran, using machines, with which he obtained better results, both as regards increased yields and reduced labour. The method is as follows:

*Preparation of the land*, in June, July and August; a MOLINE plough, cutting to a depth of 9 inches was first used, then a MUES sub-soil plough, also cutting to 9 inches.

*Harrowing* (about 6), with disc harrow, every 15 days during summer to keep down weeds.

*Preparation of furrows for planting*; (best time September or October), the furrows were made in squares 7 feet apart both ways, so as to plant 900 plants per acre; these furrows were about 15 inches deep and the plough followed by a small two-horse plough, loosening the subsoil to a depth of about 6 inches.

*Planting*, the cane was planted at the intersecting points of the marking out, from 4 to 6 selected cuttings of 3 eyes each, planted slantwise, with the eyes looking up, and lightly covered

*Harrowing*, with a small-toothed harrow 6 days after planting.

During the rest of the rainy season a MOLINE plough cultivator was used every 10 days, going the way of the furrow till this was filled up, and afterwards all possible ways that the planting admitted.

During the dry season a MOLINE cane cultivator was used every 15 days.

The cost of work done by machine is only slightly less than that done by hand, but with machines 2 men per day can care for 6 acres, whereas 48 men are required to do the same work by hand, so that, by using machines, labour may be diverted to other work.

Not only was the crop (25 to 40 tons per acre) larger with machines, but the juice obtained was better, perhaps on account of the wide planting.

The cane was cut by hand, well down, if possible under the ground.

II. — MANUFACTURE OF THE SUGAR. — On small holdings the sugar is obtained by very simple methods. It is consumed in the country and known under the following names, which also indicate the quality and origin: — 1) *panela* or *dulce*, a dark brown product, sometimes rather lighter, containing all the molasses; 2) *pilon*, a white or brown sugar, run into moulds and clarified after boiling; 3) *Mascabado* or *Muscovado*, a light or dark brown sugar made on some holdings. To make this, the mascabado, immediately after boiling, is beaten up to a powder and dried in the sun. This sugar keeps well in the dry season, but goes wet in the rainy season.

It is difficult to estimate the cost of making these sugars, because the work is done by members of the family and friends, who are only paid very little.

Large sugar producers may be divided into two groups — the Trust group and — the outsiders. The trust group has 7 factories with a total production of 150 000 quintals. The outsiders have 9 factories producing 80 000 quintals. The trust group have enough land to raise their annual production to a million quintals, and the other group could do the same. There are also 1 000 000 acres of land suitable to sugar growing, an important factor in the progress of the industry.

Most of the sugar made by the large producers is consumed in the Republic, but a fair amount is exported to San Francisco.

No improved methods of manufacture are used. The smaller plants, where there is only a single crushing, yield about 125 lbs. per ton of cane; in the larger plants the yield is from 140 to 195 lbs. per ton of cane. There are three qualities of sugar: 1) good white sugar; 2) nearly white sugar; 3) light or dark brown sugar. The prices are respectively 12, 11 and 9 pesos (1) per 100 lbs. The cane is generally of very good quality, the juice running from 9° Beaume at the beginning of November, and 12 and 13° Beaume in February and March.

47 — *Capparis albitrunca*, a South African Plant Furnishing a Coffee Substitute. — See No. 5 of this Review.

48 — Production of Santal Oil in Mysore, British India. — See No. 5 of this Review.

49 — Tobacco Growing in Ireland (The Experiments in 1916). — KELLER, G.N., in *Journal of the Department of Agriculture and Technical Instruction for Ireland*. Vol. XVII, No. 3, pp. 461-466. Dublin, 1917.

The current scheme of tobacco experiments in Ireland, covering a period of ten years, and financed out of the Development Fund, was inaugurated in 1914.

The number of growers, the total areas cropped in 1916, at the two centres where experiments were conducted, and the quantity of tobacco produced at each centre are as follows:

(1) 1 peso = 18° 9d. at par. (Ed.).

Centre	No. of Growers	Acres	Preliminary Packed Wt. lb.
Adare, Co. Limerick; Mullacrew, King's Co.	51	83	(1) 11 500 (estimated)
Randlestown . . . . .	67	89	58 668

(1) 43 000 lb. dry weight were destroyed by fire on January 1st., 1917.

The varieties grown were: Copper King and Kentucky Black. At Randlestown centre, Rich Wonder and Yellow Mammoth, two varieties closely akin to Copper King and Kentucky Black were also grown on a commercial scale. The following varieties in addition were grown at Randlestown centre for the purpose indicated:

2 acres of Burley	{	For the production of bright pipe cutters
2 1/8 " Irish Gold		
4 1/4 " " "	{	For the production of a cigarette tobacco of the Virginia type.

At Adare centre three roods of Irish Gold and a half acre of Giourkioi were grown for the production of cigarette tobacco of the Virginia and Turkish types respectively. In addition to the seven varieties which were grown on a commercial scale, tests were conducted on a small scale at one centre with two varieties and three hybrids.

The results of experiments with varieties were as follows:

*For Roll and Plug.* — No variety tested proved better than Copper King, which had a superior habit of growth.

*Bright Pipe Cutters.* — Broad Leaf Burley and Irish Gold proved quite suitable for the production of bright pipe cutters, but both varieties were very susceptible to root rot, and also proved much more difficult and expensive to cure than heavy dark tobacco.

*Cigarette Tobacco.* — A severe attack of root rot seriously interfered with the experiments with the Irish Gold variety for cigarette purposes. At one centre a half acre of Giourkioi, a Turkish variety, was planted very late and gave a very poor return.

The results of the year's work with bright tobaccos, suitable for cigarette and pipe cutters, emphasized the fact that the production of these types of tobacco involves greater difficulty and risk than the production of heavy dark tobacco.

Experience and careful tests have shown that it is very difficult to cope with the root rot disease, caused by the fungus *Thielavia basicola*. Some crops were imperceptibly damaged, others were almost completely destroyed. Tobacco grown on moory land and rich friable loam suffered least.

For the rehandling of the 1915 crop both centres were equipped with the latest pattern of PROCTOR continuous, automatic, redrying and ordering machine.

The experiments indicate that a Proctor machine would be a very effi-



cient and economic instrument in the preparation for market of Irish tobacco if the growing of the crop were on an extensive and permanent basis. The rehandling equipment at each centre represents a capital outlay of, approximately, £ 2000.

Under commercial conditions, such as exist in America, the annual charge for this equipment would be distributed over the produce of 1000 acres or more.

Any tobacco produced in 1915, which was not sold to factories controlled by the experimenters, was disposed of through tobacco brokers and merchants.

In 1915 the preliminary packed weight of the tobacco grown on the total area of 225  $\frac{1}{8}$  acres was 144 289 lb. Of this quantity a total of 132 689 lb. has been sold at an average price of 7d. per lb. The cost of growing pipe tobacco in 1915 ranged from 3d. to 11.8d. per lb. and the cost of rehandling at the different centres ranged from 1.6d. to 3.3d. per lb. These figures are exclusive of any charges in respect of capital or supervision. The packing and bonding of the 1916 crop has not yet been completed. No difficulty is anticipated in selling the crop, the prohibition of the importation of tobacco having strengthened the demand and increased the prices for Irish grown tobacco.

50 — Tobacco from Northern Nigeria. — See N. 5 of this Review.

51 — The Leguminosae *Dolichos melanophthalmus* and *D. sesquipedalis* as Vegetables in Italy. — RAGIONIERI, ATTILIO, in *Bullettino della R. Società Toscana di Orticultura*, Year XLII, No. 10, pp. 149-151. Florence, October 15, 1917.

HORTICULTURE

The dolichos cultivated in Tuscany under the names of "fagiolini dall'occhio" or "fagiolini di Sant'Anna", belong to a mixture of numerous forms and varieties of *Dolichos melanophthalmus*. By separating and selecting them it would be easy to obtain improved species.

For over a century the asparagus bean ("fagiolo asparagio" or "dolico gigante" or "fagiolo di Cuba"), considered to be an improved species of *Dolichos sesquipedalis*, has been cultivated in Tuscan gardens. It is a climbing plant which reaches a height of about 10 feet. The green pods, about 18 to 20 inches long (when quite ripe they are about 31 inches long) are eaten. They are grown in soil dug deeply at the beginning of winter and manured with well rotted manure, superphosphate and a little potassic fertiliser. Sowing is carried out in mid-April in trenches from 35 to 39 inches apart, the seeds are placed two or three together at distances of about 10 inches. When the plants are large enough they are hilled up, usually after an application of liquid manure. After this all that remains to be done is to fix the plants on to their supports (cane fences, etc.) and to water them abundantly. The occasional application of liquid manure when watering during the summer improves the yield, which starts towards the middle of July and continues till the first white frosts.

Crossings between the various *Dolichos* are very easy, whereas those between the various *Phaseolus* are very difficult. Crossing *Dolichos* and *Phaseolus* never succeeded.

- 52 - **A Simple Method for Forcing Rhubarb in the Open Air.** — DUFOUR AUGUST, in *Bulletin de l'Association des Marchés de Genève*, Year XXVI, No. 52, pp. 12, 13 + 1 plate. Geneva, November, 1917.

Among the many methods in use for forcing rhubarb in the open air, a very simple one consists in using an old cask, the bottom or end of which has been removed, the other being left.

After having dressed the foot of the rhubarb in November with fresh horse manure, the cask is placed over the roots and surrounded with a sufficient quantity of stable manure and litter to warm the plant and help the leaves to grow. A heat of from 25 to 30° C. is thus obtained. If too great a heat is to be feared air is let in through the bung-hole.

The following English and American varieties are distinguished by their earliness and are well adapted to forcing: — Early Laxton Rhubarb, deeply coloured; Hotdays Giant; Hanke's Champagne; Daw's Champion; Johnston St. Martin; Dancer's Early Scarlet; Mitchell's Royal Albert; etc. (1).

#### FORESTRY

- 53 - **The Work of the Philippine Bureau of Forestry.** — FISCHER, A. F. (Director of Forestry), in *Annual Report of the Director of Forestry of the Philippine Islands for the Fiscal Year Ended December 31, 1916*. The Government of the Philippine Islands Department of Agriculture and Natural Resources, Bureau of Forestry, pp. 83. Manila, 1917.

This Report of the Director of Forestry of the Philippine Islands shows, in the first place, that the Bureau has continued the propaganda work carried out to show the people the benefits to be derived from the forest laws. The wood expert has also done important work in the study and identification of the trees and their products (2). Considerable surveying and inspection work was also done. Besides the ordinary work of the Administrative Division, mention must be made of the Division of Investigation, whose staff also gives instruction in the Forest School. The chief work carried out by this Division consisted in reconnaissance work, supplying information for the forest maps, dendrology (flora of the forest reserves devoted to experimental work; check list of woody plants of the Philippines; research on rattan [*Calamus Rotang*], rubber and bamboo plants), silviculture (growth studies, silvical notes, reproduction studies, planting, seed collection).

Reforestation is of paramount importance in the Philippines, for over 40 % of the total area is covered with cogon grass (*Imperata exaltata*), which is useless for grazing, is a fire menace, exhausts the soil and is a breeding place for locusts. Its destruction, which is necessary to protect the crops, entails great expense. A tree, ipil-ipil (*Leucaena glauca* Benth.), has been found which will kill out cogon grass within two years. Besides this tree, hunbang (*Aleurites moluccana* Willd.) and bagilumbang (*Aleurites trisperma* Blco.) were also planted.

The lumber trade improved in 1916. The principal markets for this product are those of Hongkong, China and the United States, besides the

(1) See also R. September, 1917, No. 824, p. 1260, under RHUBARB. (Ed.) (2) See: SCHNEIDER E. E. (Wood Expert, Bureau of Forestry), Commercial Woods of the Philippines: Their Preparation and Uses, in *Department of the Interior, Bureau of Forestry, Bulletin* No. 14, pp. 274 + 12 figs. 8 plates. Manila, 1916.

local market. The shortage of coal and its high cost gave, at the end of 1916, a great impulse to the production of fire wood, which is also used on the railways. In 1916, the production of fire wood reached 292 336 cubic metres (1 cubic metre = 424 board feet).

The Bureau of Forestry of the Philippine Islands administers 16 million hectares of forests, and includes 201 employees of all grades. In 1916 the revenue was distributed as follows :

Appropriations . . . . .	321 205.20 pesos (1)
Revenue . . . . .	494 447.65
Expenditure . . . . .	285 708.09
Surplus . . . . .	208 739.56
Percentage of expenditure to revenue . .	58 %

The following data on the utilisation of the public and private forests in 1916 are of interest.

	Public forests	Private forests
Timber . . . . .	341 445 cubic metres	2572 cubic metres
Firewood. . . . .	292 336 "	84 428 "
Charcoal. . . . .	2 233 "	1 815 "
Dyewood . . . . .	2 281 466 kg.	—
Tan bark . . . . .	1 543 686 "	2 237 kg.
Dye bark . . . . .	93 057 "	8 505 "
Wood oils . . . . .	63 353 "	—
Gum mastic . . . . .	1 089 448 "	—
Gum elemi . . . . .	251 657 "	—
Gutta-percha . . . . .	19 077 "	—
Split rattan . . . . .	3 112 126 "	2 187 kg.
Gogo . . . . .	157 324 "	51 "

The woods most commonly used for timber are those of the Dipterocarpaceae ("lauan", "apitong", "tanguile" or Philippine mahogany, etc.) (2). In 1916 the exports were :

Timber . . . . .	39 954 cubic metres
Copal . . . . .	1 143 938 kg
Elemi . . . . .	104 311 "
Gutta-percha . . . . .	29 962 "
Rattan . . . . .	82 100 pesos

## LIVE STOCK AND BREEDING.

54- Studies on Fagopyrismus and Similar Affections in Canada. — BRUCE, E. H., in the *Journal of the American Veterinary Medical Association*, Vol. 411, No. 2, pp. 189-194, Ithaca, N. Y., November, 1917.

HYGIENE

Fagopyrismus is an erythema of the unpigmented skin, often accompanied by nervous symptoms and which sometimes ends fatally. Its production requires the following factors: 1) unpigmented skin, 2) in-

(1) peso = 2s. 0 1/2 d. at par. (2) See B. 1915, No. 823 (Ed.).

gestion of buckwheat, 3) direct sunshine. Somewhat similar conditions may be produced by *Medicago*, *Trifolium*, *Hypericum* and *Polygonum*. The writer had occasion to study an outbreak of fagopyrismus in Yorkshire sows and young pigs belonging to the University of British Columbia, which had been running on a pasture with buckwheat in flower for only 24 hours in August 1917.

*Symptoms of the disease.* In mild cases, there is erythema and slight inflammatory swelling accompanied by intolerable itching, the region of the head and ears being the most commonly affected. In the severer cases, there may be some disturbance of breathing, digestive trouble, and symptoms of brain affection. Death may result in 12 hours. In most cases, recovery takes place in a few days.

*Treatment.* Affected animals should be moved at once into the shade. In severe cases, treatment should be given to reduce inflammation.

In May 1916 a herd of Holstein heifers, belonging to the Agassiz (Canada) Experimental Farm, which had been running in woody pasture where there were large numbers of different species of *Polygonum* were found to be suffering from the symptoms of fagopyrismus. The parts directly exposed to the sun's rays were affected, the dermatitis being confined to the white parts of the skin. This fact induced the writer to study the disease.

On July 18th, 3 white pigs were placed in the shade and fed until the 28th. as follows: — one served as a control and was fed on mixed grass and shorts, the 2nd. on shorts and red clover (*T. pratense*); the 3rd received shorts and *Polygonum Persicaria*. From July 28 to August 4, the pigs were placed in pens so situated that they could not get out of the sun. The next day, the ears of all the pigs were reddened, those of the 2nd. and 3rd. pigs being slightly the worst.

In a 2nd. experiment, made with the same animals, one was fed for 16 days on a diet of *Polygonum Hydro Piper* without any results being obtained. A yearling Holstein bull, with a great deal of unpigmented skin, was kept from August 10 to 28 in a pen in the open and fed exclusively on *Polygonaceae*: *Polygonum Persicaria*, *P. Hydro Piper*, *P. aviculare*, *P. acre*, *P. hydro Piperoides*. No ill effects, however, ensued.

In conclusion, there experiments do not confirm the opinion advanced by different writers (PAMMEL, LONG, MÜLLER, FRIEDBERGER, FRÖHNER, etc.), that other species of *Polygonum* are toxic, as well as *P. fagopyrum*.

55 - **Eradicating Tall Larkspur on Cattle Ranges in the U. S. National Forests** (1). — ALDOUS, A. E., in *United States Department of Agriculture, Farmer's Bulletin*, No. 826 pp. 23, 8 figs., 4 tables. Washington, August, 1917.

Poisoning by tall larkspur (*Delphinium exaltatum*) causes heavy loss of cattle each year in the National Forests of the United States. During the last 3 years, 5 500 head of cattle, estimated at \$ 300 000, were lost annually through poisonous plants; about 90 % of this loss is attributable to tall larkspur. The bulletin describes the efforts made to eliminate the

(1) See R. January, 1917, No. 54. (Ed.)

loss caused by this plant. Experiments made in 1913 and 1914 in the forests show that grubbing out the plants is the most effective method. The work of eradication was continued in 1915 on about 14 000 acres of cattle range in the National Forest.

The work is done by grubbing out the greater part of the root system, including the main and lateral roots. The depth depends on the size of the roots; for medium sized roots (about 2 feet) the depth should be 8 inches, for shorter roots, 6 inches suffice. Very large bunches often have large, shallow lateral roots, which should be removed to at least 4 inches from where they leave the main root, for a little more than 6 % of the larkspur survive the first eradication and grow again from the roots which have been insufficiently removed. Eradication should be carried out during two consecutive years.

The work is best carried out early in the season, as soon as the plants have grown sufficiently to be easily recognised. The plants may be left spread out in the sun for a week, after which they are so dry that the cattle will not eat them. This method is preferable to that of piling the plants and burning them, and also requires less labour.

The tool used is determined by the nature of the ground, a pick mattock, or hoe with the spur cut off and the blade drawn out to about 9 inches, may be used.

The cost of the first eradication varies from \$ 3.65 to \$ 10.10 per acre according to the number of plants, nature of the soil, and whether the range is free from rocks, willows and brush. The cost of the second eradication does not exceed \$ 1 per acre.

Grazing by sheep, which are not susceptible to the poisoning, has only a limited success which depends chiefly on the choice of the most favourable period, the spring.

Fencing off the infested land by drift fences is more costly than grubbing and should only be adopted if horses or sheep are available to graze the areas from which the cattle are excluded.

56 - **The Properties of the Serum of Animals Hyperimmunised against Glanders, and the Choice of Animals for the Preparation of Such Serum Rich in Suitable Antibodies.** — BERTETTI, E. and FINZI, G., in *Atti della Reale Accademia dei Lincei, Rendiconti, Classe di scienze fisiche, matematiche e naturali*, Series 5, Vol. XXV, Part 5, pp. 131-135. Rome, September, 1917.

The writers have attempted to prepare anti-glanders sera rich in antibodies by using the following animals: the *ass*, which is very susceptible to glanders, and when infected naturally or experimentally, usually suffers from the acute form of the disease; the *mule*, in which the disease is usually very acute (though acute cases are fairly common in that animal and chronic cases are not rare); the *horse*, in which the disease is usually chronic; the *ox*, which is naturally quite immune.

The experiments were as follows:

*Immunity obtained by using bacilli killed by chemical means.* — On August 30, 1916, a horse received an intravenous injection of a 7- to 8-day, half-culture on agar of glanders bacilli killed with a solution of bichloride

of mercury. The following injections were made in increasing doses; at the 12th. injection 5 agar cultures were inoculated. The first injections were given close together; afterwards they were given every 5 days up to the end of January, 1917, when they were given every 12 or 13 days.

*Immunity obtained by using bacilli killed by heat.* — On August 28, 1916, a horse, mule and an ass were treated like the horse mentioned above, with the difference that the bacilli were killed by heat.

*Immunity obtained by means of bacilli killed by heat and by a malleinic toxin.* — Two horses and an ass were treated with bacilli killed by heat and by malleinic toxin obtained by a special process.

*Immunity conferred on cattle by means of bacilli killed by heat and virulent bacilli.* — Two oxen were immunised subcutaneously; the first received injections of very virulent bacilli grown on agar; the second received cultures from the same stock, but killed by heat (1 to 6 abundant cultures in Petri dishes). The injections were made regularly every 5 days for about 8 months. The oxen supported the immunising treatment very well.

**RESULTS.** — In August 1917, the subjects under treatment yielded serum having the following specific qualities: very energetic *precipitating* power; *agglutinating* power very manifest, even at considerable dilutions, e. g., of 1 : 10 000 to 1 : 20 000 (the heat test showed the specific nature of the agglutinins of these sera, in showing that they were such as would confer immunity); this serum has abundance of a specific *sensitizing* agent, easily recognisable either in presence of *Bacillus mallei*, or in presence of different bacillary extracts.

The animals under treatment did not all yield a serum of equal activity. Those inoculated with broth or agar cultures of *Bacillus mallei* and with mallein gave quite inactive serum.

If the *precipitating*, *agglutinating*, and *sensitizing* powers of the various sera obtained are classed by means of numbers from one to ten, the following scale is obtained: serum from oxen, 10; serum from horses, 8; serum from mules, 4; serum from asses, 1 to 2. The power of fixing alexins, precipitating malleinic poisons and agglutinating the various races of *B. mallei* is perfectly proportional for all the sera.

**CONCLUSIONS.** — 1) It is possible to obtain from the different animals (ox, horse, mule, ass) anti-glanders sera with strong precipitating powers in regard to various malleins and cultures of the bacillus obtained by filtration, of high agglutinating power and containing specific sensitizing agents, easily recognisable in presence of the causal organism or its various extracts.

2) The existence of a more or less great individual disposition to glanders has an inversely proportional effect in the production of anti-glanders antibodies. In fact, these antibodies, which show the work performed by the organism in order to acquire immunity, are more abundant in ox-serum and diminish progressively through the horse, mule and ass.

3) According to the writers, the fact the oxen are immune to the disease should not be considered as being related to the lack of affinity

between *B. mallei* and the cellular units of the organism, as these latter are certainly and actively affected by *B. mallei*.

4) It is inadvisable to treat the animals with agar or broth cultures of the glanders virus together with mallein, with the intention of producing a complete serum, for the soluble products of *B. mallei* contained in suspension in the broth cultures, or the crude mallein injected, possibly being modified only slowly, finally neutralise *in vivo* the antibodies produced by the bodies of the organisms, or else the haptophoric (1) group of the precipitin former absorbs and fixes the precipitin.

5) The precipitins contained in the anti-glanders sera prepared by the writers are thermolabile: temperatures between 55 and 60° C destroy the functional, precipitogenous, and active group of the precipitins, which are changed into precipitoids.

The work was carried out in the "Glanders Research Laboratory" of the 3rd. Italian Army. The writers place their anti-glanders sera at the disposal of other workers.

#### 57 - Endoglobular Parasites Causing Diseases of Animals in Russian Turkestan. —

YAKIMOFF, W. L. and collaborators, in the *Bulletin de la Société de Pathologie exotique* Vol. X, No. 4, pp. 302-311. Paris, April 11, 1917.

The authors have observed the following haematozoan diseases of animals in Russian Turkestan: —

A PIROPLASMOSES. — 1) Bovine piroplasmosis, due to *Piroplasma bigeminum*, easily curable by injections of trypanoblué.

2) Equine piroplasmosis, caused by *P. caballi*; treatment with trypanoblué has given good results.

(1) According to EHRLICH's side-chain theory (1885), the cell is composed of a central molecular complex upon the preservation of which the existence and energy of the whole cell depend. Branching off from this central element are atomic groups, the so-called "side-chains" or "cell-receptors". These receptors are differently composed and each possesses its own specific affinity for food molecules brought to the cell by the circulation. These receptors bind in turn the food molecules to the cell itself, and as these are taken up and utilised in the cell metabolism, so are also toxins which may be brought to the cellular elements by the body fluids. Thus there are *nutro-receptors*, which take up nourishment, and *chemo-receptors*, which attract chemical bodies. The combination of nutro-receptor with the food molecule is temporary; but with the chemo-receptors, if the toxin be not immediately destroyed, the cell sacrifices the receptor to which the toxin is attached. The cell then increases the number of receptors, which may be produced in such number as to be liberated from the cell, and if toxin molecules be present a union takes place between the two. The injection of an immune serum is, therefore, equivalent to injecting material containing side-chains.

Ehrlich divides the side-chains, according to their structure into 3 groups: 1) receptors containing a single combining or haptophoric group, which enables them to unite with a corresponding group of their respective antigens, such as *antitoxins*, *anticomplements*, *antiserments*, etc.; 2) receptors possessing the same qualities as the first, but having an additional group, the *ergophoric* group, and by means of these the antigen is further acted upon; to this group belong *agglutinins* and *precipitins*; 3) *amboceptors*, so called on account of their possessing two combining groups; the first belong to the haptophoric group, uniting the antigen to the cell, and the second to the complementophilic group, which combines the complement of the serum. Cf. E. WALLIS HOARE, *Veterinary Therapeutics*, 3rd edition, pp. 545-547. London, 1916. [Ed.]

3) Sheep piroplasmosis, in which the *Piroplasma* is pearshaped.  
 4) Goat piroplasmosis.  
 5) Wolf piroplasmosis, which seems to be very common,  $\frac{2}{3}$  or  $\frac{3}{4}$  of the animals examined at the abattoirs of Taschkente and Boukhara being attacked, the majority only slightly; the parasites seem to resemble *Theileria*; in one case a parasite was found which was morphologically similar to *P. canis*, though it had not been found in dogs (the authors have examined practically only town dogs).

B. THEILEROSIS. — 1) Bovine theilerosis occurs in two forms: acute and chronic; the first form appears to last several days, then becoming chronic. The disease is probably caused by *Theileria mutans* or some related organism.

2) Sheep theilerosis, caused by *Th. ovis*.

3) Camel theilerosis, for which the authors have founded the species *Th. camelensis*.

4) Fox theilerosis.

C. NUTTALLOSES. — 1) Horse nuttalliosis, caused by *Nuttallia equi*.

2) Ass nuttalliosis.

D. ANAPLASMOSIS. — 1) Bovine anaplasmosis, due to *Anaplasma marginale*; described as marginal points, nearly always associated with theilerosis.

2) Horse anaplasmosis.

3) Dog anaplasmosis.

58 - Notes in Regard to Bots, *Gastrophilus* spp. — HALL, MAURICE C, in the *Journal of the American Veterinary Association*, Vol. LII, No. 2, pp. 177-181. Ithaca, N. Y., November, 1917.

The experiments described were carried out at the Research Laboratory of Messrs. PARKE, DAVIS and Co., Detroit, Michigan. In order to make sure that the parasites had been expelled the treatment was, in some cases, followed by a post-mortem examination. Carbon bisulphide (recommended by PERRONCITO and BOSSO in 1894, and by many later authors) is very efficacious against bots, expelling all the larvae. The U. S. Department of Agriculture recommends 4 doses from 10 to 12 mg. each, administered at intervals of 1 hour. The author, in his experiments, gave a dose (in capsule) of 12 mg. followed by a second dose in 1  $\frac{1}{2}$  hours, and, 1  $\frac{1}{2}$  hours later, 800 mg. of linseed oil; a few days later 3 doses of 12 mg. each were given at intervals of 1 hour.

Chloroform and oil of chenopodium are of no value against bots.

*G. intestinalis* (*G. equis*) may cause myiasis in dogs to which are fed well developed larvae from the stomach of the horse. *G. nasalis* and *G. hemorrhoidalis* only adapt themselves to the dog to a limited extent.

59 - Observations on a Contagious Camel Disease Called "Jhooling" in British India. — CROSS, H. E., in *Agricultural Research Institute Pusa, Bulletin* No. 72, 2 pp. + 4 fig. Calcutta, 1917.

"Jhoolak" or "Jhooling" is a contagious disease of camels manifesting itself in the formation of local tumours, hot and painful, of a fibrous character, and terminating in suppuration and raw patches. The disease is widely



distributed throughout the Punjab. It usually occurs in cold weather, but is met with occasionally in hot weather. The causal organism has not yet been isolated, though it is probably a fungus. Horses, buffaloes and cattle kept in contact with camels suffering from Jhooling do not contract the disease, nor can it be produced in them by inoculation of emulsion of the lesion, nor by rubbing portions of the lesion on their skin, whether the skin be scarified or not. On the other hand, healthy camels kept in contact with camels suffering from Jhooling contract the disease rapidly.

As a preventive measure, the writer advises the isolation of infected animals. The best treatment, and one which gives very satisfactory results is the following:—A strong red iodide of mercury blister should be applied, and after 3 days washed off with soap and water. The diseased areas should then be excised and finely powdered permanganate of potash applied. Three dressing at intervals of 4 days are usually sufficient.

60 – **The Mortality of Rabbits in Wet Years in Consequence of Coccidiosis.** —

RAILLIET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, No. 34, pp. 979-986. Paris, November 7, 1917.

On account of the importance of rabbit breeding on account of the war, and in consequence of the high mortality of this animal in wet years, the writer shows that the chief cause of the mortality is *coccidiosis*, which occurs in two chief forms: *hepatic* and *intestinal*; both of which may be *acute* or *chronic*.

The symptoms and course of the disease are described (being practically identical in both forms); the life-cycle of the parasite is then described. The parasite only produces sporozoites (the agents of infection) when the environment is damp, which explains why coccidiosis is prevalent in wet years.

The preventive measures for controlling the disease are described: isolating or destroying diseased or suspected animals; burning or deeply burying the corpses or viscera; disinfecting the litter with water containing 40 grms. of sulphuric acid per litre or sprinkling it with quicklime; disinfecting the cages by washing them in boiling water; not crowding the rabbits together; early separation of young from adult animals; placing the hutches in healthy, well ventilated and dry places; giving dry or cooked food in preference to green stuff, particularly when earthy and wet; putting the food in trellised mangers, placed at a certain height; providing clean, fresh water in drinking troughs that are easy to clean.

As regards treatment, the writer states that he knows no sure one. Some veterinarians prescribe atoxyl and sodium emetic (sodium tartrate and antimonyl) but its use is not safe. A less dangerous remedy is advised by English and American writers; such is a solution of iron sulphate or a solution of *cutch* (extract of *Acacia catechu*) both given at the rate of about 20 centigrammes per litre of drinking water. An Italian veterinarian, SANLORENZO, has recently announced the complete cure of intestinal coccidiosis of the bull by means of thymol given up to the dose of 15 gm. per day; doses of 25 to 50 centigrammes might be tried with the rabbit.

- 61 — **Intestinal Parasites of Poultry, Their Prevention and Treatment.** — WICKWARE, A. B., in *Dominion of Canada, Department of Agriculture, Health of Animals Branch, Bulletin*, No. 25, pp. 13 + 3 plates. Ottawa, 1917.

This bulletin was written for poultry breeders as it was found that, of all the diseases of poultry, those caused by intestinal parasites cause the greatest loss. The annual money losses from preventable causes is at least 10 % of the yearly production of the poultry industry, i. e., about 5 million dollars.

After a short description of the Cestodes, Nematodes and Trematodes found in poultry and the symptoms of infection, the author summarises the various treatments tested by him which may be recommended. One or two teaspoonfuls of turpentine per fowl seems the most efficacious cure and is one which is easily applied. In order to avoid the irritation caused by the turpentine when given through the mouth it is preferable to use a piece of rubber tubing about  $\frac{1}{4}$  inch in diameter. After the tubing has been oiled it is passed gently into the mouth and gradually worked down the gullet into the crop. The turpentine may be passed through the tube by means of a small medicine dropper.

FEEDS  
AND FEEDING

- 62 — **Feeding Studies: The Causes of the Dietary Insufficiency of Certain Rations.**  
— See No. 2 of this *Review*.

- 63 — **On the Impossibility of Watering the Milk by giving Large Quantities of Water to the Cow.** — PORCHER, CH., in *Annales des Falsifications et des Fraudes*, Year 10, Nos. 105-106, pp. 304-320. Paris, July-August, 1917.

On account of the large number of experts and chemists who still believe in "polylactie" or "mouillage au ventre", and the danger of such a belief from the point of view of the repression of fraud, the author (Professor at the Veterinary School of Lyons) shows how incorrect that idea is, according to which, the ingestion of large quantities of water by a lactating female is followed by a veritable watering of the milk.

He recalls the physiology of lactation, insisting on the fact that milk is secreted, not excreted. The researches, experiments and conclusions of MALPEAUX, MALLÈVRE, REGNARD, etc., are quoted.

The note concludes that "polylactie" (watering the milk through the cow) does not exist, and that it is nonsense, both physiologically and experimentally, that could not be used as the basis for any reasonable judicial decision.

- 64 — **Methods for Approximating the Relative Toxicity of Cottonseed Products** (1). — CARRUTH, FRANK E., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 87-90. Baltimore, Md., October, 1917.

The work described was carried out at the North Carolina Agricultural Experiment Station, West Raleigh.

In collaboration with Mr. WITHERS, the author undertook investigations into the cause of cottonseed meal poisoning. These investigations, which have not yet been published, showed that, as a rule, the relative

(1) See also *R* August, 1917, No. 741.

(Ed.)

toxicity of cottonseed meals varies with the extent to which the raw cottonseed kernels are cooked in the oil mill.

The raw kernels are highly toxic to animals since they contain about 0.6 % gossypol, a highly poisonous phenolic plant pigment. On cooking with moist heat, as in the hot pressing processes, preparatory to expressing the oil, the glands containing gossypol are disintegrated, and the gossypol spreads over the surface of the seed tissue and apparently undergoes a change which appears to be a partial oxidation. This change takes place very rapidly, for some meals which have been cooked for 20 to 30 minutes only are not markedly toxic for rats. The cooking process change the ether-soluble and oil-soluble gossypol to a substance which, *in the meal*, is no longer soluble in either ether or oil, possibly because it is in some way chemically combined with some constituent of the meal (protein). Its presence in large amounts in ether-extracted cottonseed meal may be proved by treating the meal with hot alcoholic potash. The supernatant liquid contains the substance which, like gossypol, soon oxidises, producing a beautiful blue colour. The author calls this substance, which is much less toxic than gossypol, "D" gossypol.

Cold pressed meal is not more toxic than hot pressed meal; this is due to the fact that, in cold pressed meal, about  $\frac{3}{4}$  ths. of the total gossypol of the seed passes into the oil. Thus, whereas hot pressing greatly reduces the toxicity of the cotton seed by producing a chemical change, cold pressing reduces it by passing the gossypol into the oil.

If the gossypol is present in the meal it may be extracted by ether or detected by the following microscopic method.

1) *Sulphuric Acid test for unchanged gossypol.* — A little of the meal is sprinkled on a glass slide and treated with a drop of concentrated sulphuric acid. The result is observed through the low power of the microscope. If numerous red areas appear where the acid touches the more or less broken up "glands", toxic unchanged gossypol is present. Thoroughly cooked meals and cottonseed flour show very few and very small red areas.

2) *Quantitative determination of the gossypol present in cottonseed meal using aniline as a precipitant.* — This method is based on the fact that the unchanged gossypol present in the meal is easily extracted by ether, together with the oil. Gossypol forms a very slightly soluble compound with aniline, which separates from the oily extract and may be filtered out and weighed.

**65 - Food Value of the Waste Leaves of Different Varieties of Cabbage; Investigations in Holland.** — DE VRIES, J. J. OTT., in *Nederlandsch Landbouw-Weekblad*, Year 26, No. 45, Supplement p. 1. Schiedam, November 10, 1917.

In 1912 the cauliflowers grown in Holland covered an area of 6 000 acres, red cabbage 4774 acres, and white cabbage and common cabbage 4885 acres. Estimating the quantity of waste leaves per acre at 5  $\frac{1}{2}$  tons for cauliflower and from 8 to 8  $\frac{1}{2}$  tons for white and other hearted cabbage, about 120 000 tons of such leaves are produced annually in Holland.

In order to estimate the food value of this waste, analyses were made at

the Hoorn Agricultural Experiment Station. The results obtained are given in Table I.

TABLE I. — *Composition of waste stems and leaves of different varieties of cabbage.*

	Cauli- flower stems	Leaves of cauliflower		Leaves of red cabbage			Leaves of white cabbage	
		I	II	I	II	III	I	II
Dry matter . . . . .	16.6 %	11.2 %	—	12.0 %	12.1 %	9.9 %	11.0 %	10.8 %
<i>Composition of dry matter :</i>								
Ash . . . . .	9.0	24.8	24.3	23.2	18.4	10.5	25.2	22.1
Ash insoluble in water . . . . .	—	14.8	17.1	15.4	12.6	4.5	17.6	13.7
Fibre . . . . .	55.0	11.0	16.9	14.7	14.1	15.2	12.6	12.9
Fat . . . . .	0.8	5.1	3.5	4.8	5.4	3.4	4.2	4.2
N-free extract . . . . .	24.9	33.4	33.5	41.2	43.0	14.8	42.7	2.9
Crude protein . . . . .	10.3	25.7	21.8	16.1	19.1	26.1	15.3	17.9
Pure protein . . . . .	9.3	17.1	18.2	11.4	13.9	15.8	10.4	12.8
Digestible protein . . . . .	4.5	14.1	13.4	9.3	11.7	14.3	8.4	10.4

These analyses show that : —

1) The food value of waste cauliflower leaves may be compared to that of brewers' grains.

2) Waste leaves of red cabbage have a food value double that of clover hay.

3) Waste leaves of white cabbage have a food value double that of good meadow hay.

Analyses of the different cabbage wastes for their fertilising value gave the results shown in Table II.

TABLE II. — *Percentage of fertilising elements (compared with the dry matter) in the waste leaves of various cabbages.*

	Cauliflower leaves	Red cabbage leaves	White cabbage leaves
	%	%	%
Nitrogen . . . . .	3.6	2.8	2.6
Phosphoric acid . . . . .	0.54	0.58	0.67
Potassium . . . . .	1.5	2.0	1.6
Lime . . . . .	8.2	7.8	8.6

According to calculations based on present day values, the value of such leaves as a food exceeds their value as a fertiliser.

Feeding experiments carried out with this waste on two cows at the Hoorn Experiment Station, show that leaves of cauliflower and white cabbage produce hardly any disagreeable smell or taste in the milk; red-cabbage leaves seem to have a greater influence in this respect, but it is probable

that the milk takes the characteristic taste and smell of the cabbage as a result of being left too long in the byre where the cabbage waste is kept.

The taste and smell of the cabbage may also be passed to the milk from the hands of a milker who has touched the leaves.

Cabbage leaves seem to have no bad influence on the fat content of the milk. During the experiments the cows out at pasture ate an average of from 66 to 88 lbs. of cabbage leaves daily. No bad effect was noticed on the cream. Further experiments will be made at the Hoorn Station to determine the food value of these leaves when kept in silos.

66 — **Acorns and Beechnuts as Food for Cattle** (1). — *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 44, pp. 10-11. Paris, October 30, 1917.

I. *Acorns*. — The latest work on the composition of acorns has shown them to be poor in albumin, yet very nutritious on account of their high content in nitrogen free extract (starch and sugars). They are poor in lime, phosphoric acid and ash. They are characterised by tannic acid, and a bitter element, *quercite* or acorn sugar, substances capable of causing gastric trouble, particularly constipation, if fed to animals in excessive quantities. These injurious effects are increased if the acorns are badly kept or mouldy.

Acorns are not complete foods, and pigs fed on them alone without any other protein food, suffer from cachexia of the bones, many of which fracture, and they lose in weight; their intestines turn greyish.

As a supplement to other rations acorns produce no harmful effects, and are to be recommended. Pigs fed in the sties must not be given too large a quantity of acorns, especially at the beginning of the fattening period. The ration should be completed by green fodder, rich in nitrogen and water. The acorns should be crushed and mixed with other very laxative foods such as tuber or root plants, beet slices and fairly concentrated foods, such as bran. Cooking the acorns or meal made from them may diminish their astringency.

*Quantity of acorns which may be eaten by animals accustomed to them in their daily rations.*

Horses . . . . .	9.7 lbs. of fresh acorns	6.16 lbs. of dried acorns.
Dairy cows . . . . .	9.9 " " " "	6.16 " " " "
Beef or draught oxen	13.2 " " " "	8.14 " " " "
Pigs . . . . .	3.3 " " " "	2.2 " " " "
Sheep and goats . .	1.65 " " " "	1.1 " " " "

If only a limited quantity of acorns is available, it is best to keep them for the pigs because, so long as the precautions given above are observed, they have no bad influence on the meat, except on the fat.

It is advisable to use dried acorns without the cups, which are richest in injurious elements.

II. *Beechnuts*. — They have a fairly high food content and are very digestible. As the seed contains a poison, *fagine*, it must only be included

(1) On the use of acorns in distilling, see No. 94 of this *Review*. (Ed.)

in the ration of animals to a limited extent. On the other hand, horses may eat  $6\frac{1}{2}$  lbs. of them a day without any ill effects. Beechnuts, like acorns, should be given to pigs by preference. Although they have not the energy value of acorns, beechnuts are a food for cattle which should not be ignored.

67 — **The Pulpy Mesocarp of the Fruit of *Ricinodendron Rautaneii* as a Cattle Food.** — See No. 5 of this *Review*.

68 — **The Value of Cider Apples, Perry Pears, and their Respective Pomace as Food for Farm Stock.** — I. BARKER, B. T. P. and GIMMINGHAM, C. T., The Use of Pressed Apple Pomace, in *The Journal of the Board of Agriculture*, Vol. XXII, No. 9, pp. 851-858, London, December, 1915. — II. BARKER, B. T., and WALE, B. N., The Value of Cider Apples and Pomace as Food for Farm Stock. *Ibid.*, Vol. XXIV, No. 5, pp. 530-539, August, 1917.

I. — The writers apply the term pomace to the pulp of apples and pears in the condition in which it comes from the press after the juice has been extracted.

The total acreage in Great Britain under cider and perry fruit trees is approximately 100 000 acres; this corresponds to a total annual yield of 27 500 000 gal. or 183 333 to 220 000 tons of fruit, or 55 000-60 000 tons of pressed pomace. The total crop of cider fruit is probably not less than 200 000-250 000 tons, representing a yield of 60 000-75 000 tons of pomace.

Table I gives the results of the analyses of cider pomace carried out by the writers at the Agricultural and Horticultural Research Station of the University of Bristol. For comparison, the composition of wet brewers' grains and of mangolds are also given. Speaking generally, apple pomace is of a distinctly higher feeding value than mangolds, but it falls below wet brewers' grains as regards the amount of protein, though it is richer in carbohydrates.

TABLE I. — *Percentage Composition of Pomace.*

	Mixed apples 1913	Mixed apples 1915	"Bell" apple 1915	Ponsford apple 1915	Cap of Liberty apple 1915	Pear 1915	Wet Brewers' grains	Mangolds (Medium)
Water . . . . .	74.10	76.05	68.39	75.39	75.37	65.52	76.2	88.0
Ether extract . . . . .	1.24	1.12	1.43	1.22	(1.20)	1.30	1.7	0.1
Protein . . . . .	1.82	1.53	1.03	1.54	1.33	1.50	5.1	1.2
Crude fibre . . . . .	5.14	4.42	6.52	5.75	4.30	7.86	5.1	0.9
Ash . . . . .	1.11	0.71	0.65	0.56	0.76	0.92	1.2	1.1
Carbohydrates . . . . .	16.69	16.17	21.98	15.54	17.04	22.90	10.6	8.7

WARCOLLIER, in his book "Pomologie et Ciderie", quoting from WOLFFS' tables, gives for apple pomace a content of digestible nutrients of about: 1 per cent. of protein; 12 per cent. fat; 12.5 per cent. carbohydrates; nutritive ratio about 1:16.

In cider-producing countries, pomace is fed to stock when it is fresh;

if not given in large quantities (which would be injurious, especially in the case of dairy cows), no bad results are to be apprehended. Pomace, however, undergoes a rapid acid fermentation in addition to putrefaction. The best method of preserving it is by making it into silage. The silo may be improvised by using tubs or vats, or it may be specially constructed out of masonry, or dug out in the earth, the bottom and sides being covered with layers of straw. In some of the larger cider factories, pomace-drying plants have recently been installed. The product is sold to feeding-stuff manufacturers, and employed in making compound cakes or poultry foods. When for any reason, apple pomace cannot be used for food, it may be turned into a very good manure. Ordinary samples contain from 0.2-0.6 per cent. of potash; 0.4-0.7 per cent. of phosphoric acid; 1.6 to 1.7 per cent. of nitrogen, so that pomace is richer in manurial constituents than farmyard manure, but to neutralise its acidity, it should be mixed with bone or mineral phosphates.

Pomace can also be employed for making "small" cider, or low-grade cider, as well as for vinegar production or for cider and perry brandy.

II. — Description of experiments made in 1916, with pigs at the Seale-Hayne college, Newton Abbot, in conjunction with the Agricultural and Horticultural Research Station at Long Ashton, in order to determine the effect of substituting apples, or pomace, for a portion of a daily ration consisting of : sharps, maize meal, and fish meal. The quantity of apples given was gradually increased to from  $\frac{1}{3}$  to  $\frac{1}{2}$  and the pomace till it constituted from  $\frac{1}{10}$  to  $\frac{1}{3}$  of the total weight of the ration.

The percentage composition of the apples and pomace is given in Table II.

TABLE II. — *Percentage composition of Apples and Pomace.*

	Apples		Pomace	
	Sample 1	Sample 2	Sample 1	Sample 2
Water . . . . .	83.8	83.0	67.20	71.75
Protein . . . . .	0.7	0.5	1.90	1.70
Fat . . . . .	0.4	0.3	1.47	1.05
Crude fibre . . . . .	1.2	2.6	13.70	12.22
Carbohydrates . . . . .	13.3	13.2	15.17	11.78
Ash . . . . .	0.6	0.4	0.56	1.50

The experiment was divided into 2 periods: 1) from 5th. October to 15th. December during which both apples and pomace were used; 2) from 16th. December to 15th. January, during which only pomace was used. The results obtained at the end of each period are given in Tables III and IV. Each group contained 5 animals.

These Tables show that: 1) for fattening pigs of 55 to 60 lbs. per head, neither cider apples nor pomace give as satisfactory results as maize meal

and fish meal; 2) both apples and apple pomace possess a distinct feeding value for older, and store, pigs.

TABLE III. — *Experimental Results for Period I.*

Lots	Live weight at start	Live weight at end of Period I	Gain in live weight in 71 days.	Calculated carcass weight	Food consumed					Total meals	Total meal consumed per lb. live-weight increase
					Apples	Pomace	Sharps	Maize meal	Fish meal		
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
1	214	514	300	364.59	1 142	—	547	390	91	1 028	—
2	213	527	314	375.66	570	—	669	390	91	1 150	3.66
3	211	555	344	398.32	—	—	771	390	91	1 252	3.64
4	212	514	302	372.34	73	251	652	390	91	1 133	3.75
5	213	520	307	376.68	35	355	614	390	91	1 095	—

TABLE IV. — *Experimental Results of Period II.*

Lots	Live weight at start	Live weight at end of Period II	Gain in live weight in 30 1/4 days.	Actual Carcass weight	Food consumed			
					Apples	Pomace	Sharps	Maize meal
	lb.	lb.	lb.	lb.	lb.	lb.	lb.	lb.
2	527	671	144	491	9	220	125	302
3	555	713	158	526	—	—	515	302
4	514	673	159	501	—	151	454	302

## BREEDING

69 — **Inheritance of Coat Colour in Swine: Experiments in the United States.** — SEVERSON, B., O., in *The Journal of Heredity*, Vol. VIII, No. 8., pp. 379-381, 1 fig. Washington, August, 1917.

The Mendelian principles of unit characters, dominance, and segregation appear to manifest themselves in the colour characters of pigs. SMITH (Colour Inheritance in Swine, in the *American Breeder's Magazine*, Vol. IV, p. 113) has shown that in the case of a Yorkshire crossed with a Berkshire, or with a Poland China: 1) white was dominant as regards black in the  $F_1$  generation; 2) in the  $F_2$ , the colours showed a general tendency to the separate manifestation of the original parental colours, in the ratio of 3 dominants: 1 recessive; 3) in almost every case, the black recessive of the  $F_2$  was accompanied by much more white than was present in the black parents. This suggests the idea that several chromosome factors, rather than a single one, are required for each colour. A. I. SIMPSON and J. P. SIMPSON (Analytical Hybridization, *Proceedings of the American Breeders' Association*, Vol. VII, p. 266), in a study on the crossing of different breeds of swine, state that: "The exact application of Mendel's law to all hybrid pigs in those cases where the original animals had been proved to be pure-bred and homozygous, and the resemblance between the pre-fertilisation chromosome reduction processes in animals and sexual plants,



leads us to conclude that all pure-bred swine fully obey Mendel's law, and that, if in crossing, a marked deviation occurs, this is positive proof of contamination in the case of one, or both, subjects".

In the experiments carried out at the Pennsylvania State College the writer observed the following facts: In the spring of 1915 were born a litter of young pigs, the offspring of a Berkshire sow, Dora XVIII of Penn. State 199 330 and a Duroc Jersey boar, Fancy King 58 875. Of the young pigs, 6 were red, spotted with black, and one black spotted with white. In the spring of 1917, another litter, produced by mating a pure-bred Duroc Jersey boar with a pure-bred Berkshire sow, contained 5 young pigs, of which 4 were red spotted with black, while 1 was black with the white spots of the Berkshire. The appearance in the 1st. generation of a black animal spotted with white had never been observed in any of the practical experiments at the above-mentioned College.

The case being an exceptional one, this black and white female of the  $F_1$  (1915) was chosen with one of its sisters from the same litter, and which showed the usual black and red coloration, for use in further experiments. As regards the case of the black and white pig born in 1917, the factors of heredity have not yet been investigated.

The hybrid white and black sow, born in 1915, was called No. I, and its sister No. II. These sows ( $F_1$ ) were both mated at the age of 1 year with a pure-bred Berkshire boar, Rival's Duke XXII 193 411, with the object of determining if the black and white sow No. I possessed any hereditary factor for red; sow No. II was used as a control.

### *Results of Mating.*

Parents		Colour of offspring (numbers of cases)			
Boar	Sow	Red and black	Black and white	Red, black and white	Yellow and black
$F_1$ — Duroc Jersey 38875	Berkshire 199330	6	1	—	—
$F_2$ — Berkshire 193411	Hybrid No. I	1	5	2	1
$F_2$ — Berkshire 193411	Hybrid No. II	6	4	4	—

The litter produced by mating the hybrid sow No. I (black and white) with a Berkshire boar showed a greater variation than that given in the above Table. At the end of the summer of 1915, the white hair of this sow became yellowish, as is usual in the case of white pigs, but in the winter, it again became pure white. At the age of 1 year, however, a narrow yellowish band appeared between the ears, extending down the back of the neck for from 4 to 6 inches. In the litter of 5 pigs which are described as black and white, one alone could be termed pure black with white spots. The others had reddish hair round the groin. One pig only was red and black, and in this case, the black was dominant, with patches of red bristles. The predominance of black as regards red in  $F_1$  had never been observed by the writer in the  $F_1$  of a Berkshire  $\times$  Duroc Jersey cross.

The usual arrangement of the colour of  $F_1$  did not appear in the 2nd generation when sow No. I was mated with a Berkshire boar. One pig was light brownish-yellow spotted with black. Two pigs showed distinctly the 3 colours black, red, and white. One of these had a black body with irregular patches of red and white. The other animal had 5 longitudinal bands of reddish bristles on a black body spotted with white. The last case is interesting, because young wild boars have longitudinal stripes on their bodies. This would seem to be an exception to the fact observed by CASTLE (*Genetics and Eugenics*, p. 137), who says that the character of stripes would appear to have disappeared in all domestic races of pigs, which are exclusively black, pink or white, or else black spotted with white, or red spotted with white. The only explanation of these longitudinal bands on the body would seem to be, that the determinants of their heredity are not entirely eliminated by improved breeds of pigs.

Given that in the litter produced by sow No. I, eight out of nine of the young pigs showed red, or traces of red, coloration, it is evident that this sow possessed a chromosome character for the colour red. It has been stated that in Berkshire pigs red is hereditary, but it does not seem reasonable to conclude from this case that sow No I did not possess the factors for the 3 colours black, white and red.

A litter of 10 pigs were obtained from the mating of sow No. II with the same Berkshire boar. The sow had a red body spotted with black. She also changed considerably in colour when over 1 year old; the red bristles on the abdomen and face becoming a pale yellow. The colour of the litter of sow No. II was more uniform than that of the young of No. I; 2 of the pigs being red spotted with black — 4, black spotted with white — 4, reddish black with white spots. There appeared to be a reversion in the colour dominance in the cases of sows I and II. In the first, black replaced red, as the ordinary fundamental colour, and white spots took the place of the usual black ones of the cross Berkshire  $\times$  Duroc Jersey. In sow No. II, which was of the usual fundamental colour, red with black spots, the white colouration was recessive or inhibited by some other factor. In the case of sow No. I, the factor for the longitudinal bands on the body, which are found in the wild boar, may have prevented the expression of its red factor. The fact that this sow had a narrow red stripe on the back of the neck, leads us to suspect that this may have been the case.

*Colouration in the other crosses.* — The following are the observations made by the writer as regards the colour obtained in the  $F_1$  by crossing the different breeds.

- 1) Berkshire  $\times$  Tamworth: Red (darker than in Duroc Jersey) spotted with black.
- 2) Berkshire  $\times$  Duroc Jersey: Red (of various shades) with black spots. Black (rare) with white spots
- 3) Berkshire  $\times$  Yorkshire: White (uniform) — White with black spots (rare).
- 4) Yorkshire  $\times$  Tamworth: White (uniform) with reddish shade.
- 5) Yorkshire  $\times$  Duroc Jersey: White (uniform) with reddish shade.
- 6) Berkshire  $\times$  Chester White: White (uniform) — White spotted with black (large proportion).

These observations do not confirm the general opinion that the uniform white of the Yorkshire breed is completely dominant as regards the red of the Tamworth and Duroc Jersey breeds.

70 — **The "Beirão" Horse in Portugal.** — MONTEVIO, ANASTACIO, in the *Revista de Medicina Veterinaria*, Year 16, No. 186, pp. 166-169. Lisbon, August, 1917.

HORSES

The breeding of "beirão" horses was fairly well developed in 1870; at that period, although retrograde, the breed was still plentiful on the Lisbon market, where it provided nearly all the cab-horses. Afterwards, the "beirão" horse quickly gave place to mule-breeding, and, in 1886, it was only bred in the plateau of Cõa.

All the Portuguese horses have the same origin, differences between the various breeds being due to different environment, attention, etc.

The "beirão" horse may be distinguished from the related breeds in southern Portugal by: its small frame, rarely more than 5 feet high; a heavy fleshy head; badly placed and rather thick ears; squat shape; somewhat coarse hair; very crooked hind joints; a coat where dark colours predominate. Those bred on the plateau of Cõa, where they are better looked after, are better, being more stylish.

The "beirão" horse forms a breed zootechnically distinct owing its origin to the special environmental conditions, such as: being bred in a granitic, mountainous, uneven region with the temperature varying round 0° C or still lower during more than half the year; total absence of the most simple care and attention, etc.

71 — **Milking by Machinery.** — HOPFER, J. J. and NUTTER T. W., in *The Field Illustrated*, Vol. XXVII, No. 10, pp. 755, 806, 810 and 812. New York, October, 1917.

CATTLE

Since 1913, at the Kentucky Experiment Station, 30 cows a day are milked by machine. Occasionally, when through some accident to the motor, it is necessary to milk by hand, 2 men can milk the herd in 1  $\frac{1}{4}$  hours, but more usually they need 1  $\frac{1}{2}$  hours, or 3 hours a day for the two milkings. With a machine the work can be done in 45 minutes, or 1  $\frac{1}{2}$  hours a day, but washing and attending to the apparatus before and after milking require another 1  $\frac{1}{2}$  hours. An expert workman can milk by hand as quickly as the machine, which takes 4 minutes to milk a cow, but, with the machine, two cows can be milked at once, and the milkers prefer the machine.

Mechanical milking is advantageous with a herd of 30 cows, and the larger the herd, the more necessary it becomes. With a herd smaller than 30 there is less to be gained by the use of a machine.

The four machines at the Kentucky Experiment Station cost \$568; in four years, repairs and new rubber parts have cost about \$448. The electric power used costs about \$3.90 a month or \$1.56 per cow annually. The combined cost of repairs for the machine and for power amount to \$5.31 per cow per year. Possibly a small gasoline engine would decrease the expense.

From data obtained from the Station and from the Elmendorf dairy, where 400 cows are kept, it was seen that the lactation period was extended from 11 to 16 months. Frequently mechanical milking was replaced by

hand milking during 1 or 2 weeks, during which little or no change was noticed in the milk flow. It should be noted that, unless the cows are carefully stripped by hand after machine milking, they dry off very rapidly.

By hand stripping a small quantity of milk, varying from half a teacupful to half a pint, is obtained. Hand stripping has the advantage of allowing the condition of the teats to be observed; it is carried out while the machine is milking another cow. To obtain perfect results the machine must work perfectly, faulty pressure may do harm, and the presence of blood in the milk may be attributed to it, but it is easily remedied. During 4 years only 5 cows were found which did not take to mechanical milking.

As many as 5 % of the cows in a herd may not be satisfactorily milked with a machine, but the other 95 % are accustomed to it after 2 or 3 milkings. Milk was obtained with as few as 50 to 100 bacteria per cc., and the bacterial count rarely exceeded 2 000 to 4 000. The average bacterial count of station milk published by the Lexington Health Board for July was 500.

The machines are cleaned with warm water, washing powder and a hard brush. The detachable parts are then rinsed and placed in an anti-septic solution. Just before milking, the teat cups and tubes are washed with water. Vigilance and care in cleanliness are absolutely essential both in machine and in hand milking.

The advantages of mechanical milking may be summarised as follows: it makes the work easier and the workmen are better satisfied. It does not decrease the amount of labour required, but makes it less hard.

#### POULTRY

72 - **Poultry Feeding Tests in New Zealand.** — BROWN, F. C., in *New Zealand Department of Agriculture, Industries and Commerce, The Journal of Agriculture*, Vol. XIV, No. 6, pp. 464-468, 1 fig. Wellington, June 20, 1917.

With a view to finding a substitute for wheat, which hitherto had been generally considered as an indispensable item of a laying fowl's diet, the New Zealand Department of Agriculture, in May 1915, instituted feeding tests at its Milton Poultry Station. The object of these tests was not to aim at high egg records, or high profits over the cost of production, but to ascertain, as far as possible, what results could be obtained by the elimination of wheat from the ration.

The offals of wheat, pollards and bran were included in the dietary.

The 1st. year's tests lasted from May 1, 1915 to April 28, 1916; 4 pens each containing 6 fowls took part: 2 of white Leghorns (pens 1 and 3), and 2 of Brown Leghorns (pens 2 and 4). One pen of each breed had wheat in the ration and the others none.

The 2nd. year's tests commenced on May 1, 1916 and concluded on April 30, 1917. Pens 1 and 3 received the same dietary as in the preceding year; in the case of pens 2 and 4, the only alteration was that lucerne-meal was substituted for pollard. It is interesting to observe that the leading pen, No. 4, received no pollard or wheat.

*Conclusions.* — Wheat and even pollard, are not indispensable in the dietary of the heavy layer when oats and lucerne-meal are both substituted.

Hens in their 2nd year, with both wheat and pollard eliminated from the ration, can produce a profitable number of eggs; meat-and-bone meal

*Poultry-Feeding Tests.*

No. of pens	Number of eggs laid per pen	Average number of eggs laid per fowl	Food consumed	Cost of food	Value of eggs
				£ s d	£ s d
<i>1st year.</i>					
			lbs.		
1	1 428	239	Pollard . . . . .	275	
			Bran . . . . .	103	
			Maize-meal . . . . .	93	8 18 7
2	1 403	243	Meat-and-bone meal . . . . .	86	
			Wheat . . . . .	426	9 0 4
3	1 433	238	Pollard . . . . .	240	
			Bran . . . . .	91	
			Maize-meal . . . . .	93	8 16 5
			Meat-and-bone meal . . . . .	85	
4	1 449	241	Lucerne-chaff . . . . .	173	
			Oats . . . . .	406	9 0 7
<i>2nd year.</i>					
			lbs.		
1	956	159	Pollard . . . . .	133	
			Bran . . . . .	43	
			Maize-meal . . . . .	40	2 2 0
			Meat-and-bone meal . . . . .	17	6 2 8
			Meat-and-bone meal (fed separately)	25	
			Wheat . . . . .	229	
2	1 079	179	Lucerne-meal . . . . .	104	
			Bran . . . . .	43	
			Maize-meal . . . . .	36	
			Crushed-wheat . . . . .	71	2 2 5
			Meat-and-bone meal . . . . .	20	7 0 7
			Meat-and-bone meal (fed separately)	23	
			Wheat . . . . .	189	
3	1 012	173	Pollard . . . . .	112	
			Bran . . . . .	38	
			Maize-meal . . . . .	40	
			Lucerne-chaff . . . . .	82	2 2 0
			Meat-and-bone meal . . . . .	21	6 12 2
			Meat-and-bone meal (fed separately)	22	
			Oats . . . . .	202	
4	1 211	201	Lucerne-meal . . . . .	110	
			Bran . . . . .	40	
			Maize-meal . . . . .	36	
			Crushed oats . . . . .	77	2 3 9
			Meat-and-bone meal . . . . .	21	7 13 10
			Meat-and-bone meal (fed separately)	27	
			Oats . . . . .	192	

makes a good substitute for boiled meat. The quantity of meat-meal eaten is largely influenced by the number of eggs laid. This is indicated by the quantity of meat-meal consumed by pen 4 (See Table).

A large quantity of meat-meal can be consumed by heavy-laying stock without injurious effects such as ovarian troubles, provided the meal is chiefly supplied in a separate hopper and kept always before the birds for them to pick at.

Lucerne-meal is preferable to the chaff-hay form of lucerne as an egg-producer, and also as a labour-saver, steaming over night being unnecessary.

73 — **Turkey Rearing in Italy.** — CASTELLARI, A., in the *Gazzetta Agricola, Commerciale e Industriale, Organo del Consorzio delle Cattoliche Ambulanti di Agricoltura per la Provincia d'Alessandria*, Year 1, No. 21, pp. 141-142. Alexandria, Italy, November 15, 1917.

Among the chief breeds of turkey (Norfolk black, Cambridge buff, common black, English white, bronze), the best is the bronze, especially for its early maturity and weight producing qualities (on an average 35 lbs. for the mature, and 24 lbs. for the young turkey, cock; 25 lbs. for the mature hen and 15 for the young hen). Crosses have been made, particularly at Ravenna, between the white English breed (delicate flesh, but not so hardy as the common black) and the common breed, and excellent results have been obtained. The common turkey hen produces about 40 eggs a year if she sits; if she does not, double the number may be laid. The hen can do three successive sittings of 30 days each without any harm if given abundant food; according to her size she can sit 20 to 24 eggs, so that in 90 days, from 60 to 70 turkey-chicks would be obtained per turkey-hen.

The writer gives the following rules for feeding:

No food to be given for the first 48 hours after hatching.

First food: bread (even of maize) soaked in skim milk, mixed with 1 hard egg for 5 chicks and a finely chopped onion.

Ten days after hatching, flour mash (maize, rye, etc.) mixed with finely chopped chicory, nettle and onions.

At about 1 month, a pinch of pepper should be added to the mash.

At 2 months, always give cooked food, divided among 4 meals a day; later, 2 meals will suffice.

During the critical period in rearing turkeys, seeds of hemp, flax, millet, rye, oats, wheat, *well cooked*, should be preferred, as well as stale bread and waste meat; add a little pepper and chopped onion.

In fine weather, the flock should be sent to pasture.

During fattening, which begins a month before sale, the time spent out at pasture must be decreased, and well varied food given, always cooked and salted; thus, give mash in the morning and grain in the evening (oats are very good).

The following daily rations suffice for 20 turkey chicks; the total cost of the first 2 is about 2½d.; that of the 3rd about 2d.; they are most suited for seasons when other fresh food is lacking.

I. — Maize flour, 4 parts; sesame cake, 4 parts; Oats, 2 parts (cooked and salted); ~~and~~ weight, 2.2 lbs.



II. — Cooked potatoes, 8 parts; sesame cake, 4 parts; rye, 3 parts (cooked and salted):  
— *total weight*, 3.2 lbs.

III. — Kitchen waste, cooked potatoes, 6 parts; maize flour, 4 parts (cooked and salted):  
— *total weight*, 2.2 lbs.

The common breed, when suitably fattened, will reach the following weights: male, 20 to 22 lbs.; female, 11 to 13 lbs. An 11 lb. turkey-hen will give: 62.5 % of meat; 8.5 % of bone; 4 % of fat; 6 % of feathers; 19 % of blood, viscera, etc. Turkey flesh contains, on an average: 55 % of water; 20.6 % of nitrogenous matter; 22.9 % of fat; 1 % of ash.

Three hens and a cock were kept by a small household; 120 turkey-chicks were hatched, of which 90 lived and were reared.

The accounts were made up as follows:

## EXPENSES.

Upkeep of 3 hens . . . . .	19 s.
Upkeep of 1 male . . . . .	6 s. 5 d.
Upkeep of the chicks for the first 3 months . . . .	120 s.
Cost of guarding while at pasture . . . . .	60 s.
Cost of fattening, at 1s. 2 $\frac{1}{4}$ d per head . . . . .	109 s.
<i>Total Expenses</i> . . . . .	313 s. 5 d.

## RECEIPTS

90 turkeys, averaging 15 lb. each, i. e. 1350 lbs. at 13.4 d. per lb. . . . .	1824 s. 2 d.
Manure produced at 9 $\frac{1}{2}$ d. per head . . . . .	71 s. 3 d.
<i>Total receipts</i> . . . . .	1895 s. 5 d.
<i>Total profit</i> 182 s. or £ 189 2 s.	

74 — **Transmission of Richness in Silk and Hardiness in Crossing Silkworms.** — GRANGEON, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. 3, pp. 888-891. Paris, October 10, 1917.

SERICULTURE

The author (ex-director of the sericultural Station of Nanisana, Madagascar) points out that, in tropical countries, it is essential to rear hardy breeds, as the methods of the natives are not sufficiently careful and larvae of all ages have to eat a mixture of young and old mulberry leaves, owing to the method by which the tree is cultivated. They also have to bear a very high temperature and a moist atmosphere.

There are very hardy breeds, especially in Bengal, but the larvae, which are quite small, only give a cocoon with a very thin covering of silk.

It seems impossible to combine the two characters *hardiness and richness in silk*. In Bengal very clear results were obtained on the transmission of these characters to the products obtained by crossing native breeds with improved European and Madagascar breeds.

In all the crossings the silk-worms of the 1st. generation distinctly have the hardiness of the mother and those of the 2nd. and 3rd. generations a hardiness intermediary to that of the father and that of the mother. The larvae of the following generations gradually divide up into small, resistant larvae and large larvae with but a slight resistance which die out.

In all the crossings the larvae of the 1st. generation have the richness

in silk (if anything slightly increased) of the parent, male or female, which is richest in silk. Those of the 2nd. and 3rd. generation have a richness in silk rather inferior to that of the 1st. generation, then individuals rich in silk gradually die out in the following generations. The dying out of these worms is caused by the climate and does not occur if the crossings are made at such an altitude as to attenuate the effects of the climate.

These facts show that crossing a Bengalese female with a male of improved breed would give, in the first generation, silkworms having the hardness of the Bengal breeds and the richness in silk of the European ones. Cocoons rich in silk would thus be obtained in a climate fatal to improved breeds. The two following generations might also give satisfactory results during a good part of the year.

The difficulty is to obtain, at the requisite moment, males of improved breeds, which must be kept pure. Moreover, if the larvae hatch out well in the first generation, it is a different matter in the following generations when a polyvoltin is crossed with a monovoltin. All these difficulties may be overcome if there is a mountainous district near enough, which does not require a journey of from 10 to 12 days (as is the case in Madagascar). In the mountains of tropical countries where the altitude is sufficient to make the climate temperate it is easy to obtain improved polyvoltin breeds throughout the year. Moreover these breeds may always be obtained by crossings (followed by selection) between European monovoltins and polyvoltins of tropical countries.

**75 - The Appearance of "Accidental Bivoltins" in Univoltine Breeds of the Silk-worm.** — LÉCAILLON, A.: I. On the Appearance of "Accidental Bivoltins" in Univoltin Breeds of the Silkworm and the Explanation of this Phenomenon, in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 18, p. 603-605. Paris, Oct. 29, 1917. — II. On the Special Characters Shown, at Various Stages of their Development, by "Accidental Bivoltins" appearing in the Mulberry *Bombyx*. *Ibid.*, No. 20, p. 683-685. Nov. 12, 1917.

I. — "Accidental bivoltins" are 2nd. generation silkworms sometimes found among univoltin breeds. The author gives the following results of the observations and experiments he has carried out on this supplementary generation, observed for a long time by breeders:

1) In 1917, the univoltin breed, studied since 1914, gave 3 cases of bivoltism.

The first was that of the pair which matured earliest, and appeared on June 18. The fertilised eggs of this pair began to hatch 10 days after being laid (a fact which, normally, should only occur after 9 ½ months). About 400 eggs were laid by the female, 377 of which produced larvae and a few only remained at the customary stage of normal univoltin eggs which hibernate; 10 larvae died in the eggs.

Two other females, born on June 21 and 27, whose copulation was prevented, laid eggs, some of which produced, a few days after being laid, larvae which died as soon as they hatched (1).

(1) On the subject of pathogenesis in the silkworm, see R. October, 1917, No. 936, and R. November, 1917, No. 1050. (Ed.)



2) In order to see whether temperature could cause bivoltinism, experiments were made in which the cocoons, then the moths and eggs, of a univoltin breed were placed in a special room, the temperature of which was always kept at 25 to 30° C., *i. e.*, some degrees higher than that at which the eggs are usually laid. There were no bivoltins.

3) It seems that the appearance of bivoltins may be explained as follows:

a) The embryos, larvae, chrysalides, and moths from different eggs laid by the same female mated with a single male are far from being identical either from a morphological or physiological point of view. The time required by the embryos to form within the egg especially, is very inconstant. The remarkable difference between various individuals of the same parents is due to the fact that the ovules of a single female are no more identical with each other than are the spermatozoa of a single male.

b) Direct action of environment is not the determining cause of accidental bivoltinism.

c) It is known that the action of cold, high temperature, brushing, electricity, and acids will cause ordinary univoltin eggs to hatch prematurely. In the production of accidental bivoltins, however, it is only a question of the direct and prolonged influence of the breeding conditions which acts on the composition of the eggs which are being formed, and doubtless also, on the developing spermatozooids.

d) In the author's experiments, the eggs kept for reproduction remain, during the first 3 months after being laid, at a temperature which is often as high as 30° C. During winter the temperature is not below 5 or 6°. It is probable that, under these conditions, the univoltin embryos are so influenced that those which already have the capacity of transforming rather quicker than the others, have this tendency accentuated. From them are descended, in the following spring, moths whose progeny is more or less entirely accidentally bivoltin.

Finally, the author points out that this phenomenon must be gradually more marked in rearing if, from year to year, the moths which appear first are used for breeding.

II. — "Accidental bivoltins" seem to represent an important step in the scale of the changes that a univoltin breed may undergo to form a well defined bivoltin one, and, in order to help comprehension of the variations produced in the species during centuries of rearing under different climates and which may still be produced, the author gives the special characters of the bivoltins appearing in his rearings at all the stages of their development.

a) The eggs of the 3 layings where the author observed cases of accidental bivoltinism were so poor in yellow colouring matter that they appeared almost completely white. Their chemical composition was, therefore, different from that of ordinary univoltin eggs. Consequently, the conditions of rearing, when they cause the production of accidental bivoltins, first cause changes in the chemical composition of the egg, particularly of the vitellus.

b) During the embryonic development of the accidental bivoltins, the colouration of the egg changes only slightly, owing to the small amount of colouring matter present.

c) Contrary to the general belief, the author is of the opinion that most accidental bivoltins can be easily reared, breeding being normal, and that these larvae are no more subject than ordinary univoltins to the diseases, etc., that commonly attack *Bombyx*.

d) The author has noticed no particular difference between accidental bivoltins and normal univoltins in their other stages, *i. e.*, as chrysalis and perfect insect. Copulation and oviposition were quite normal; the number of eggs laid by accidental bivoltin females corresponds with that laid by ordinary univoltins.

76 - **Methods of Identifying Silkworm Eggs Made Bivoltin by the Action of Hydrochloric Acid; Investigations in Italy.** — ACQUA, C, in *Rendiconti dell' Istituto bacologico della R. Scuola di Agricoltura in Portici*, Vol. II, pp. 75-77 Portici, 1917.

Of recent years there has been a large demand for silkworm eggs for the summer-autumn rearing. Among the treatments to which the eggs are subjected to make them hatch prematurely are immersion in a suitable dilution of hydrochloric acid and exposure to "electric rain". It sometimes happens that there are put on the market eggs said to have been treated electrically which, in reality, have only been subjected to the hydrochloric acid bath. The deception may be discovered by the following characters of eggs treated with hydrochloric acid:

1) Dark brick-red colour inclining to a violet, almost wine, shade; the eggs remain this colour till just before they hatch, when they turn pale, finally becoming the same colour as ordinary eggs.

2) Complete removal of the sticky layer which envelops the eggs in the natural state and enables them to adhere to objects and each other, Silkworm eggs treated with hydrochloric acid are not sticky and may easily be run through a narrow funnel.

These characters are common both to the native yellow and Chinese breeds and to crosses between them.

Eggs treated electrically do not change colour, but only become a little less dark and their colour is indistinguishable from that of other eggs with which they are compared. There is no effect on the sticky layer.

77 - **"Akino-nogeshi" (*Lactuca brevirostris*), A New Silkworm Food Recently Discovered in Japan.** — *Le Moniteur des Soies*, Year 55, No. 4870, p. 2. Lyons, December 8, 1917.

Mr. FUJIMA DAIJIRO (chief of the Oi branch of the Silkworm Institute of the Gifu Prefecture) has recently discovered that a plant "akino-nogeshi" (*Lactuca brevirostris* Champ.), is probably not inferior to the mulberry in silkworm feeding. He obtained excellent results with this food; larvae fed on it from the first stages gave, if anything, better cocoons than those fed on mulberry leaves. This discovery is of great value in districts where frosts injure the mulberry trees. As the plant in question is hardy and wild, it can be left to grow in the mountains or plains without any special care being given it.

78 - **Carp-Breeding in Transplanted Rice Fields: Experiments at Vercelli, Italy (1).** — MARCARELLI, B., in *Il Giornale di Riscoltura*, Year VII, No 19-20, pp 218-253. Vercelli, October 15 and 30, 1917.

FISH CULTURE

It is especially due to the "Società vercellese di agricoltura" that, for some 3 years, carp breeding is spreading in the rice fields of the province of Vercelli. Although this new industry has not yet passed the experimental period, yet it has given very encouraging results. It should be remembered that, besides its value, the carp is an excellent help in combatting malaria, and destroying weeds by eating their seeds (Prof. SUPINO has found seeds of *Glyceria Polygonum*, *Cyperus* and *Chara*, etc., in the intestine of the carp), as well as hindering their germination by agitating the surface of the soil.

The rice-growing Station of Vercelli has done much propaganda work for rice-growing by transplanting (2); this is why the Station advocated the trial of carp-breeding in transplanted rice-fields. Towards the end of June, 1917, mirror-carp fry, from Galicia, were placed in two plots of the Station's experimental field, each plot measuring about 6000 sq. yds. On July 11, 180 small carp, each weighing from 16 to 19 gm. were added to the fry in one of the plots. Nothing further was done, save to regulate the water supply. On August 26, the water was drained from the rice fields and, 2 days after, the fish were collected and found to weigh from 150 to 180 gm. for the fry and 300 gm. for the small carp. The fish were put in a pond for the winter.

The writer concludes from these results that carp breeding in transplanted rice fields is possible if fry or young fish of 1 or 2 summers are used. On the other hand, the use of mature fish cannot be advised, seeing that the season is too far advanced when the water has to be run into the rice fields (about mid-June). In comparison with the directly-sown rice field, the transplanted rice field offers the following advantages: — freer and quicker circulation for the fish, giving easier feeding and quicker growth; the possibility of always keeping a constant supply of water; greater saving of special work such as ditching, etc. The presence of carp in the transplanted rice field causes no damage whatever, especially if the precaution is taken, when small carp of 1 or 2 years are used, of not putting in the fish till 10 or 12 days after transplanting, that is, when the plant is well rooted.

79 - **The Amazon Turtle as a Producer of Eggs, Meat and Fat.** — TAVARES, J. S., in *Boletim, Serie de Publicação Cientifico*, Vol. XV, Part. VI, pp. 279-283, fig. 2. Braga, November, 1917.

OTHER LIVE STOCK

Turtles are extraordinarily abundant in the Amazon and its tributaries. The true turtle (*Podocnemis expansa*) is adult at about 10 years old; it is then about a yard long; the dorsal carapace will measure about 31 inches, while the body weighs from 26 to 33 lbs. As the carapace has no horny scales, like those of the marine turtles, it is of no commercial importance. The eggs and meat are utilised, however.

(1) See also: F. SUPINO, *Carp-Breeding in Rice Fields in Italy*. B., September, 1913, pp. 1332-1335. — (2) See B., 1915, No. 271. (*Id.*)

At the egg-laying season, the turtles appear in hundreds on the banks of the river and dig pits about a foot deep and 2 to 3 ft. wide, in which, after about a fortnight, from 60 to 140 white and almost spherical eggs are laid. The females fill up the holes with earth, which they afterwards smooth over to hide the place. Incubation is by the heat of the sun; shortly the young turtles appear and enter the water in search of food.

The natives ("caboclos") hunt for eggs, testing the ground with a stake, until a hollow sound is obtained. The eggs are equally eatable whether raw or cooked. By a very crude process, the natives extract a fat called "turtle butter" from the eggs, to use as food or for burning. The fat is sold in tins of about 40 lbs. at an average price of 11 milreis (24s. 8d. at par). The turtle butter is mostly prepared in the regions of Upper Amazon, Jurna, Tefé, Rio Negro, Purus, Yutahy, Madeira, Solunões and Javary; thousands of pound's weight are sent every year to the market at Belem de Para.

Tortoise meat forms a great part of the food of the poorer classes; that of young animals is more appreciated, thus costing more. Living turtles are often sent to Europe, where the meat, particularly used for making soup, constitutes a very delicate dish.

The turtles are captured either by hand, by shooting with arrows, with hooks, or with nets.

When the turtles are wandering along the banks of the river at egg-laying time, the natives chase them and turn them on their backs. They are then quickly (10 to 15 minutes exposure to the sun suffices to kill them while on their backs) taken in canoes and kept alive in water, in enclosures called "currales" surrounded by stakes to prevent them from escaping. The turtles are kept thus until sold or eaten. The price of an adult turtle, formerly very low, now varies from 5 to 20 milreis (11s. 3d to 45s. at par). In addition to the true turtle (*Podocnemis expansa*), the natives on the riverbanks of the Amazon also hunt other Chelonians, such as; the "tracaja" (*Podocnemis du merihana*); the "kágado da matto" (*Rhinemys nasuta*); "jabuty machado" (*Platemys platycephala*); "jabuty aperema" (*Nictoria punctularia*); "matamata" (*Chelys fimbriata*); and the "mussuau" (*Cinosternum scorpioides*). very abundant in the island of Marajó.

## FARM ENGINEERING.

80 - The Tractor in Relation to the Farm and Its Machinery. — KRANICH, F. N. G., in the *Transactions of the American Society of Agricultural Engineers*, Vol. X, No. 2, pp. 101-108. Ames, Iowa, March, 1917.

According to the writer, there exist, between the tractor and its environment, relations of three types:

- 1) Relations to draft machines,
- 2) Relations to belt-power machines,
- 3) Relations to the economics of the farm

These factors are all equally important, but, unless the tractor's utility can be divided equally among them, it is not a success on the farm.

*Draft machines.* — Considering the actual horse power required, ploughing constitutes the heaviest work of farming, though not the longest in actual hours of work. Milking requires at least an hour morning and evening for one man, which totals to 73 days of 10 hours per year. Ploughing on the average farm requires less than 20 days per year. Farmers often consider tractors as merely ploughing machines; to this end the horse drawn gang ploughs have been adapted for use with tractors, as the other farm draft machines will probably be. The disc harrow, the spring tooth harrow, clod crusher, etc., are best used right behind the plough.

Most of these machines are usually drawn by 2, 3 or 4 horses; too much power would be wasted were they hitched alone to the tractor. Several of these machines should be combined, or one large machine should be constructed, to form a sufficient load for the tractor.

But it remains to be seen if that is desirable, for each binder or mower would require a man, so that the measure would defeat its usefulness. Moreover, the extra expense of these machines would cost too much per unit of production. Again, the small tractor is limited in power, and the size of farm for which it is suited would not require 2 or 3 binders, mowers, or harvesters. Drawing a manure spreader, a tedder or rake is ordinarily work for 2 horses. The tractor's relation to either of these machines is questionable. The tractor can, of course do this work, but is it economical? A spreader is empty half the time and then is not even a load for a 2-horse team. To draw 2 or 3 spreaders by a tractor might not be economical, on account of the time lost in loading, hitching and handling. Harrows, manure spreaders, etc., might be adapted to tractors, but it would increase the machinery cost to the farm, as well as necessitating changes to provide accommodation for them. Would this be considered economic farming, and would the method lower the cost of production? In the next few years, the tractor will certainly reach such a stage of development as to render it still more useful. Farm machines will be built in sizes to suit economical working of the tractor and they will be of better design and construction. The tractor does not need to replace all the farm horses, but it must replace some to prove its economic value. If the tractors replaces horses of value equal to twice its cost, it has served a great part of its intent.

*Belt-power Machines.* — The tractor should be able to drive the belt or power machines of the farm; but the tractor and the machines (grain separator, huller, saw, etc.) should be so arranged as to work at the maximum capacity consistent with efficiency. Convenient belting should be provided as well as proper speeds without unnecessary pulley-changing. A tractor suitable for belt work only would not be considered an economic farm machine. It is probable that few of the gas or steam tractors used in the United States represent a profitable investment for their owners, for they remain idle so much of the year, because belt work, primarily threshing, was their purpose.

It is the variety of things done economically by the tractor during the year that makes for its close relationship to the farm and its machinery. If belt work is the principal aim, the portable engine will solve the problem

at half the cost of a tractor, for most of the expense of the tractor lies in its transmission parts, which are for draft work.

*Farm Economics.* — The economic relation between the tractor and the farm in general is very important. Although closely related to the draft machines and power machines, the tractor may prove rather an expense than a saving, if it is not in proportion to the whole farm. Thus, an 80-acre dairy farm, with 5 horses, would obtain no economic advantage from the purchase of a 15-30 HP. tractor, which, although of first-class construction, would be more suited to a 600-acre farm.

The tractor will bring about a new era in farm machinery. Its value is only just beginning to be recognised. Farm machinery will be redesigned to meet the needs of tractor farming, as well as being constructed to give better and longer service. At present it is often of poor quality. It should work more efficiently, have a longer life, which would give better profit and reduce the unit cost of production.

81 — **Machine Cultivation Tests at Noisy-Le-Grand, France** (1). — RINGELMANN, MAX, in *Feuilles d'Informations du Ministère de l'Agriculture*, Year 22, Nos. 39 and 41, pp. 7-9 and 12-13, tables 7. Paris, September 25 and October 9, 1917.

The author's second report on the trials at Noisy-le-Grand (France) deals with 12 machines indicated in the appended Table, which summarises the results of the work carried out.

As a supplement to the special trials in 1913-1914, 1915, 1916 and 1917 (which concerned 63 machines) the writer formulated a number of conclusions, the chief of which are given below.

The weight of the tractors should not be more than 6160 to 6600 lbs.; such machines are easy to handle and give an average tractive effort of from 1320 to 1540 lbs. Above such a tractive effort, the machines do not last long, the axles are strained, thus resulting in greater wear and tear, with a reduced length of life.

When the work (breaking-up or deep ploughing) requires a tractive effort of more than 1320 to 1540 lbs., recourse should be had to a winch tractor.

To provide for good steering, about one-third of the total weight should be carried by the steering wheels and two thirds on the driving wheel or wheels. Two steering wheels are more effective than a single one.

The weight of the tractor in relation to the width of the wheels should not be more than 170 to 180 lbs. per in. of tyre width (figure obtained and checked at the trials). Neither the width of the tyres nor the diameter of the driving wheels (43 to 55 ins.) should be increased too much.

In the case of exterior transmission to the driving wheel or wheels (gears or chains) a clearance of at least 10 to 12 ins. should be left between the ground level and the lowest point of the drive or gear box.

A differential should be dispensed with, one driving wheel or 2 driving wheels placed close together being used instead. With one driving wheel working in the furrow and the other on the unploughed land, the strain falls

Machines	Fuel	Stated H. P.	Sale Price without plough	Number of order	Ploughing		Average speed per hour	Average time for turning second	Time required to plough per hectare	Surface actually ploughed per hour	Fuel consumed		Tractive effort		Average speed of the plough		Tractive effort at draw-bar kg. metres per second	H. P.
					Depth	Width of work					per hect- are	per hour	Average total	per sq. dm.	kg. m. per second			
J) Gray. . . . .	Petrol	25	25 000	25	11.8 16.2	1.45 1.45	3 816 3 060	30 30	2h 36m. 3h 3m.	3 846 3 174	9.81 7.84	25.5 24.3	1 177.1 1 517.4	68.8 64.6	1.06 0.85	1 247.72 1 289.79	16.63 17.19	
K) Bull. . . . .	"	26	11 000	28	10.8 15.3 18.2	0.95 0.95 0.64	4 032 3 492 3 999	20 20 20	3h 34m. 4h 3m. 5h 21m.	2 802 2 472 1 872	4.52 4.79 4.84	16.2 19.1 25.6	— — —	— — —	— — —	— — —	— — —	
L) Chase. . . . .	"	16	15 000	31	9.2 13.0	1.04 1.04	1 944 2 268	40 40	6h 45m. 5h 54m.	1 482 1 692	4.04 4.25	27.0 25.0	653.4 596.2	66.2 51.5	0.54 0.63	342.03 438.60	4.56 5.84	
M) Amanco. . . . .	Paraffin	24	12 500	33	12.3 13.6	1.04 1.09	3 672 3 420	30 30	3h 41m. 3h 46m.	2 676 2 632	6.58 7.12	24.3 26.3	726.4 871.4	58.8 61.9	1.02 0.95	740.92 827.83	9.87 11.03	
N) Perroquet. . . . .	"	25	17 000	35	14.8 16.2	.00 1.05	3 780 3 672	25 20	3h 45m. 3h 39m.	2 700 2 868	8.68 11.8	32.1 38.7	930.9 1 020.6	61.9 60.0	1.05 1.02	970.50 1 041.01	13.02 13.88	
O) Heurenx-Fermier	Petrol	16	9 500	(2)	—	—	—	—	—	—	—	—	—	—	—	—	—	
P) Tank. . . . .	"	35	22 000	(2)	—	—	—	—	—	—	—	—	—	—	—	—	—	
Q) Case. . . . .	"	18	13 500	37	17.4 21.0	0.73 0.76	3 816 3 744	20 20	5h 12m. 4h 47m.	1 936 2 088	4.45 4.89	21.8 22.9	553.7 853.8	43.6 53.5	1.06 1.04	586.92 897.95	7.82 11.84	
R) Globe. . . . .	"	18	12 000	39	5.5	1.56	3 492	40	2h 45m.	3 636	5.31	14.3	651.2	75.9	0.97	631.06	8.42	
S) Blanchard. . . . .	"	4	(4)	40	14.5	0.26	1 980	60	28h 11m.	335	0.92	25.9	239.4	63.5	0.55	131.67	1.75	
T) Desaulles. . . . .	"	10	(4)	41	2.5	1.56	3 600	40	2h 41m.	3 756	2.25	6.0	335.0	85.9	1.00	335.0	4.46	
U) Galard and Pa- tuzzo. . . . .	"	6	7 000	44	9.7 14.6 15.6	0.54 0.32 0.32	1 872 2 196 2 196	40 40 40	13h 45m. 19h 47m. 19h 47m.	730 595 595	2.93 3.17 3.79	40.1 62.7 75.0	— — —	— — —	— — —	— — —	— — —	

(1) The tractor towed, on freshly turned soil, a 48-tine harrow weighing 90 kg. — (2) Ploughing tests could not be carried out. — (3) The tractor towed a 13 flexible-tine harrow on the ploughed land. — (4) First machine built; no price yet fixed. — N B. The machine S is a double-brabant plough, on the fore part of which are fixed a small motor and two hauling winches.

constantly on one side of the differential, one of whose gears wears more quickly than the other.

As regards grips fixed to the driving wheels strakes of various forms damage the ground much less than grouts and other types of grip which tend to pack the soil.

The strakes should run on the unploughed ground; turning the last strip of ground destroys the compressed part, which does not take place when one of the driving wheels runs on the furrow-bottom; in this last case, the packed parts covered in ploughing remain unchanged in hard blocks; this difficulty does not occur in sandy soil. One driving wheel may run in the furrow, but it is inadvisable.

Motors of 20 to 25 HP., with several cylinders of the automobile type and running at high speed, are preferable.

The circulating pump should be gear-driven, while the fan should be driven by a belt.

Endless-track devices (caterpillar treads) should be avoided on account of the difficulty of steering and the rapid wear of the many articulations.

The front-bogie tractors act almost like motorploughs; steering the driving wheels is difficult on account of their weight on the soil, especially if one wheel, provided with grips, runs in the furrow. The steering of the wheelbarrow type of motor plough is also difficult.

The double-brabant windlass plough, which has been largely tested, is of interest for average cultivation.

With a pull of from 1320 to 1520 lbs., an average speed of 3250 yds. per hour seems suitable; the speed may be increased up to 4300 yds. per hour, but on further increasing it, steering becomes difficult and the traction of the implement becomes too heavy. Under similar conditions of work, period, soil, plough, the tractive effort increases from 100 to 118 when the speed increases from 1 to 2.5

The use of the tractor is best suited to furrow lengths of not less than 500 feet. The time required for turning is about  $\frac{1}{2}$  a minute (20 secs. with a good driver, 1 minute with an unexperienced man).

Two men are required: 1 mechanic on the tractor and an ordinary assistant on the implement being towed; this latter does not exclude automatic lifting.

More than 50 minutes of actual work per hour cannot be relied upon.

A traction buffer should be placed between the tractor and the implement being towed. In this way an economy of 33 to 54 % is gained on the starting-pull and 19 to 30 % on the average tractive effort, which only affects a part of the hourly consumption of the tractor while reducing the wear of the machinery.

It is worth while hitching a harrow to the plough for ploughing before autumn sowing and for that of spring.

The great advantage of the tractor, resulting from the area it can cover per hour, is that the farmer can immediately utilise the favourable opportunity for ploughing.



The tractor is used to best advantage on furrow lengths of from 3250 to 5000 ft., in fields with slopes of not more than 7 or 10 %.

Travelling by road should be reduced as far as possible, unless the grips are removed from the driving wheels, and other precautions taken.

**82 - Machine Cultivation Trials at Bourges, France, in 1917.** — DESSAISAIK, R., in the *Journal d'Agriculture Pratique*, Year 81, No. 23, p. 450. Paris, November 15, 1917.

The departmental Syndicate for machine cultivation of Cher has carried out ploughing tests with tractors in September 1917, near Bourges, France. M. E. RABATÉ, Director of agriculture for the department of Cher, noted the following results :

Tractor	HP.	Average depth of work, in cm.	Area ploughed per hour, in sq. metres	Petrol used per hectare, in litres	Cubic metres of earth turned per litre of petrol
Mogul. . . . .	16	17.2	2 614	23.30	73.8
Titan. . . . .	20	19.0	3 528	21.25	89.4
Case. . . . .	20	17.0	2 925	28.23	60.2
Avery. . . . .	16	18.5	1 707	21.15	87.1
Emerson. . . . .	20	18.0	2 604	32.90	54.7
Gray. . . . .	30	17.0	3 255	27.20	62.5
Moline. . . . .	12	17.0	2 092	29.00	58.6
Globe. . . . .	18	57.0	2 196	43.90	38.7

In these trials the furrow length varied between 728 and 998 ft.

The Case, Avery, Moline and Globe tractors each towed a 2-furrow plough ; the Mogul, Titan and Emerson tractors towed a 3-furrow plough ; while the Gray tractor towed a 4-furrow plough.

**83 - The Cost of Fuel used by Tractors for Ploughing, in Canada.** — ATWOOD, CHARLES A., in *The Canadian Thresherman and Farmer*, Vol. XXII, No. 10, p. 32. Winnipeg, Canada, October, 1917.

The writer has used a kerosene-burning tractor of 8-16 HP. on a 200-acre farm for all cultivation work and for working a hay-press and a chop-cutter.

The tractor worked 67 days during a period of 3 months ; the number of working hours was 403, or 6 hours a day.

The work was done on a heavy loam soil, where 3 ploughs are a maximum load for the tractor used (a small size one), and where, without a good operator, 2 ploughs could be handled to better advantage and less overload to the engine at moments of extra stress. The costs per acre are given below.

In the spring cultivation the tractor pulled two 8-ft. disc harrows and a 10-ft harrow.

To work an acre required 38 minutes, the cost for fuel and lubrication

tion being 18 ½ cents per acre. Very few repairs were necessary during the first year of operation.

Work.	Cost of fuel and lubricant per acre.	Time required per acre.
Spring ploughing (maize stubble) . . . . .	\$ 0.27	1 hr. 12 min.
» » » » (clover sod) . . . . .	\$ 0.31	1 hr. 24 min.
Early autumn ploughing (oats stubble) . . . .	\$ 0.27	1 hr. 9 min.
Late autumn ploughing (oats stubble) . . . .	\$ 0.30	1 hr. 11 min.
Late autumn ploughing (wet, maize stubble).	\$ 0.40	1 hr. 30 min.
December ploughing (clover sod) . . . . .	\$ 0.36	1 hr. 42 mins.

84 — The "Motoculteur", Built by the "Société La Motoculture Française". — FREMIER, VICTOR, in *Le Génie Rural*, Year 9, No. 69; New Series, No. 9, pp. 1-5, figs. 3. Paris, 1917.

The "Motoculteur" <sup>1</sup>(1), which took part in the Noisy-le-Grand trials, is the 30 HP. 1917 type embodying all the latest improvements.

The frame properly so-called is formed by what might be called the

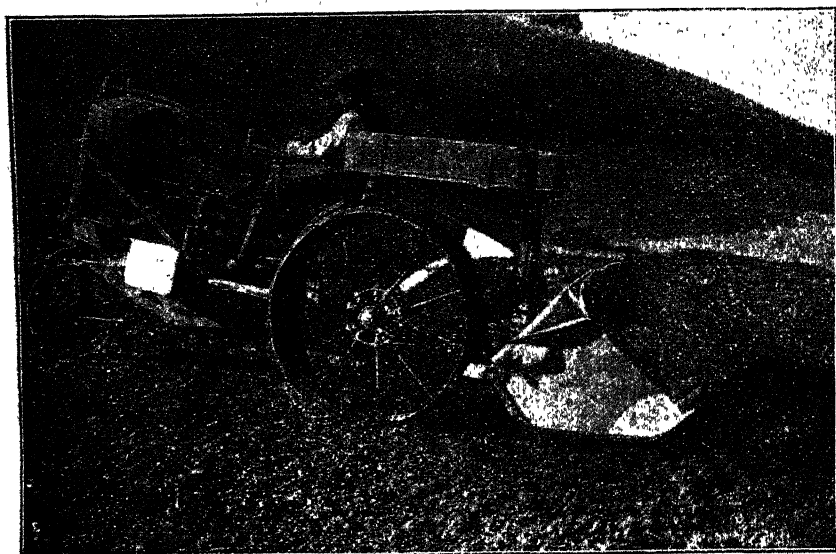


Fig. 1. — The "Motoculteur" working while mounting a 14 % slope.

1) In the *Notes de Culture Mécanique* by DR. CHAUVÉAU (Librairie Bailière, Paris, 1917), there are described 4 types of "Motoculteurs" constructed by the Société LA MOTOCULTURE FRANÇAISE, Boulevard Hausmann 41, Paris. These types are: 1) Maraîcher; weight, 440 lbs.; 4-5 HP.; price, £ 80; 2) Vigneron, weight, 3 300 lbs.; 16 HP.; price, about £ 200; 3) for large scale work; weight, 4 400 lbs.; 30 HP.; price, £ 610; 4) for large scale work; weight, 5 060 lbs.; 40 HP.; price £ 600.

"belly" of the machine, which contains and protects the machinery working in a bath of oil. There is no external greaser. The total length of the machine is 13 feet, the width being 5 ft. 3 in. The machine (fig. 1) is carried on two driving wheels and a single steering wheel; it is very stable as the centre of gravity is very low, being situated a little forwards of the driving wheels. The latter are of 47 in. diameter, and are placed at a point  $\frac{2}{3}$  of the total length. The motor is 4 cycle, 4 cylinder and gives, at 1000 to 1250 revolutions, from 30 to 35 HP. (bore 90, stroke 170); it is provided with a governor. The carburettor includes an automatic air-filter; the fuel consumed is 0.4 litres per HP.-hour; the tank holds 60 litres. The magneto is enclosed and completely protected from dust. There is a friction coupling and 4 gears giving speeds of 15, 25, 36 and 59 inches per second respectively, as well as a reverse.

As is shown in fig. 2, the rotary apparatus of the "Motoculteur" is placed behind; there are 2 speeds (150 and 180 revs.) which allow of

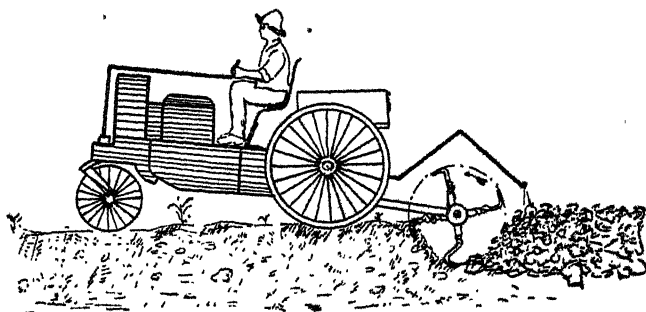


Fig. 2. — Diagrammatic side-view of the "Motoculteur" showing the rotary apparatus.

regulating the work according to the soil and the type of tilth that is required. The transmission to the apparatus is by a central, universal joint drive.

The machine turns in its own length (in a circle with a radius of less than 10 ft.) and, having no differential, turns on the free interior driving-wheel. The machine guides itself when travelling in a straight line, so that the driver can descend from the machine, if necessary, and walk alongside to examine the work, etc. The 1917 type of "Motoculteur" can perform two functions: 1) by means of its extensible rotary apparatus, work the soil completely, producing a *uniform tilth over all the layer worked* in a single journey and in widths of from 59 to 71 ins.; 2) without its rotary apparatus, work as a tractor, towing all the usual farm implements, including multiple furrow ploughs or digging brabants.

The rotary apparatus, tearing at the soil in the direction of movement

can, even in a loose, damp soil, ascend with its ordinary wheels slopes of more than 15 %, when fully working.

On the other hand, when used as a tractor, removable strakes giving a good grip are provided for the driving wheels ; in addition, when its normal weight does not exceed 4000 lbs, extra weight can be given by means of sacks of earth or lead bars of 1100 to 2200 lbs. In this state the machine gives, in suitable ground, a draw-bar pull equal to 50 % of its total weight, or 1980 to 2640 lbs. The gears are designed for such strains.

Thanks to its lightness, the machine can work with its rotary apparatus in all fields, even on deeply ploughed land, with a single turn, and it can prepare such land for sowing much better than scarifiers and harrows. On solid land, the machine can produce a loose tilth of from 2 to 11 or 12 ins. deep, according to the speed at which it moves. This type, at any rate, is not designed for deeper work, but it can carry it out as a tractor by towing a digging brabant.

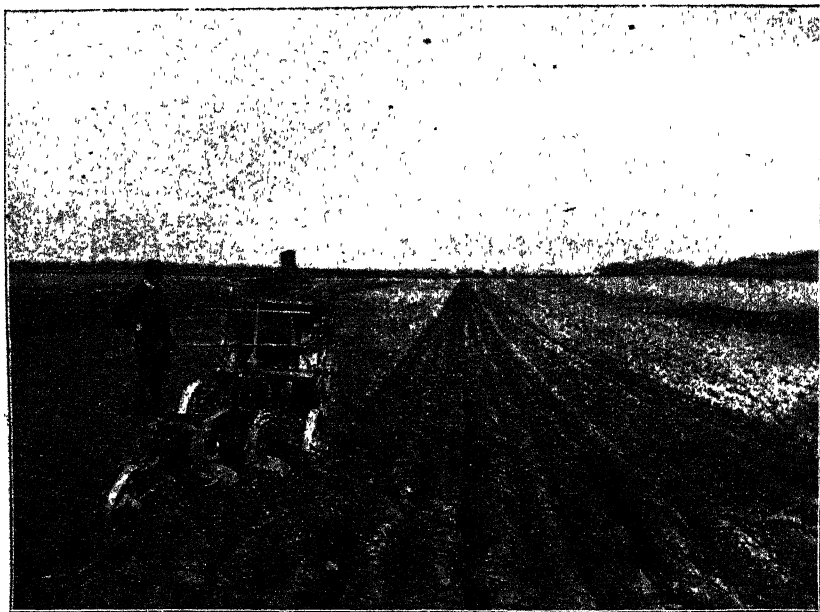


Fig. 3 — The "Motoculteur" working as a tractor

In normal soil of 110 to 132 lbs resistance, with a width of 1300 to 1625 feet, the machine is guaranteed to yield per hour of actual work (complete work and with a single turn of the rotary apparatus) as follows :

- 1) at least 1 800 sq yds at 9 to 12 ins deep (1st speed forward)
- 2) " " 3 000 " " " 7 to 10 " " (2nd speed forward)

- 3) at least 4 800 sq. yds. at 5 to 7 ins. deep (3rd. speed forward)
- 4) " " 7 200 " " " 2 to 3 " " (4th. speed forward) for hoeing, ploughing-up stubble.

In practice, deducting stoppages and the usual losses of time, the machine will perform : about 3.25 acres of hard digging-work, either loosened or brabant-style; about 6.25 acres of average work, tillage or ordinary ploughing with a 3-furrow plough ; about 15 acres of hoeing or ploughing-up of stubble.

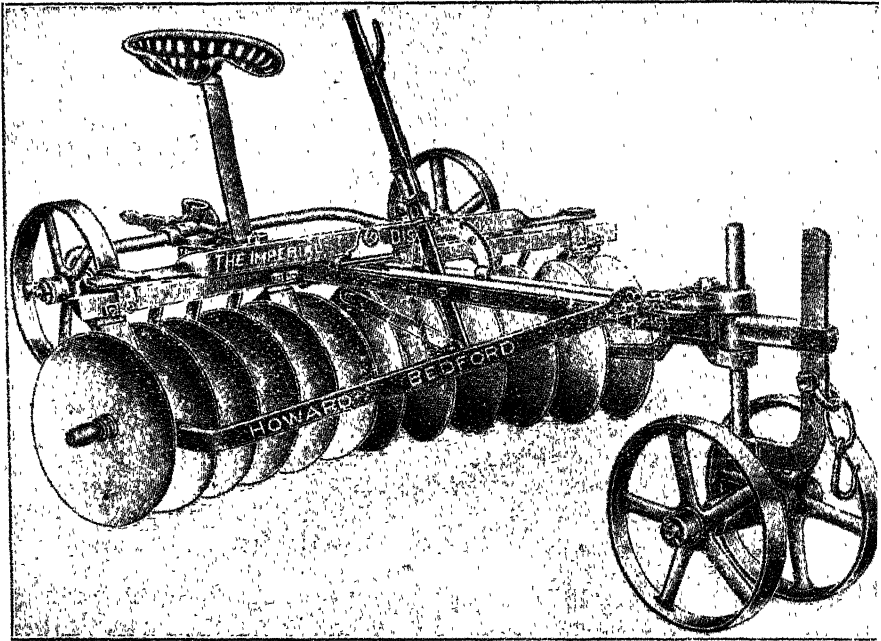
The working tools each consist of a claw and a spring, fixed together on the rotating axle, without screws or bolts ; they are interchangeable and easily replaced if broken. The wear of the claws depends on the kind of soil ; in rocky soils or for certain work it is advisable to use the machine as a plough-tractor.

The " Motoculteur " is provided with special seeders, and it ploughs, harrows down, sows and rolls all in one turn (cereals, maize, beets, etc.). It can be used for planting potatoes, the fertiliser being sown simultaneously. When standing at the farm, its engine drives the fixed farm machinery. A single workman is always sufficient to drive the " Motoculteur ", no matter what the work is.

According to M. FRÉMIER, the work done by the " Motoculteur " seems to be all that could be desired from the point of view of modern agricultural science. In a single turn, it will obtain that uniform structure in the whole layer of earth worked that is necessary for a perfect *seed bed*. According to the crop, and according to the soil, be it dry, wet, or even pebbly, the size of the clods and the fineness of tilth required are easily regulated. When the soil is covered with a normal layer of farmyard manure, the machine mixes it intimately with the soil throughout the cultivated layer, thus favouring nitrification. Only a small part of the longer straws and residue remains visible on the surface. As for other fertilisers and dressings, the motoculteur mixes them evenly throughout the cultivated layer. If the machine is used on land covered with vegetation (lucerne, mustard, vetches, lupins, etc.) or stubble, it tears the plants to pieces and buries the fragments. However, for such work which is heavy on the engine, sharper claws placed closer together should be used.

85 - Howard's "Imperial" Disc Harrow. — *The Implement and Machinery Review*, Vol. 43, No. 517, p. 722, 1 fig. London, November 1, 1917.

The "Imperial" steel disc harrow, illustrated below, is constructed by Messrs. J. & F. HOWARD, of Bedford, England. The transport wheels at the rear of the implement can be easily raised during working, and, conversely, the harrow raised for travelling. By a lever, the discs can be adjusted to suit the peculiarities of the ground. The fore-carriage possesses a rocking movement from which great advantage is derived on rough and rocky land. This disc harrow is suitable for attaching behind a plough towed by a tractor. It is made in four widths, with 12, 14, 16 and 20 discs of either 18 in. or 20 in. diameter.

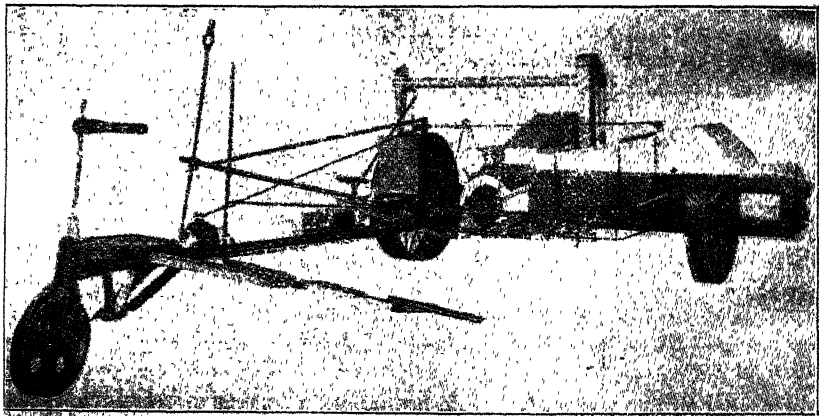


HOWARD'S Imperial Disc Harrow.

86 - Mower for Gathering Kelp, in the United States. — See No. 19 of this *Review*.

87 - The Baldwin Standing Grain Thresher. — *Farm Implement News*, Vol. XXXVIII, No. 79, p. 25, 1 fig. Chicago, September 27, 1917.

This machine, reproduced below, does not head the grain, but draws the heads into a threshing cylinder which shakes out the kernels and leaves



The BALDWIN Standing Grain Thresher

the straw standing uncut. It handles a 12-foot swathe. The machine is drawn by horses or a tractor, but the operating mechanism is driven by a WANKESHA motor. All the gears are enclosed and HYATT roller bearings are used extensively.

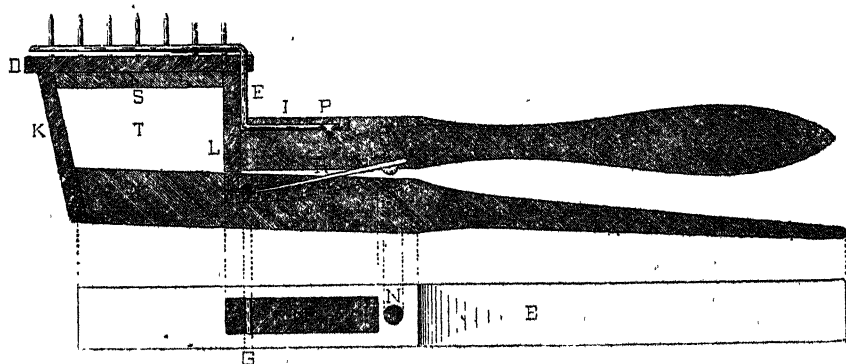
The grain is delivered into sacks by the machine. One or two men suffice for attention. In regions where there is little fear of lodging and where all the grain ripens at the same time, the machine should save a deal of hand-labour.

A number of the machines are already in use in western Nebraska, Kansas and Texas.

88 - **The Rebuffel "Olive Gleaner"**. — REBUFFEL, A., in *Republique Française, Office National de la Propriété Industrielle, Brevet d'Invention No. 484560, 1 p. + 6 figs* Published at Paris on October 18, 1917.

A new apparatus, called the "Olive Gleaner", for rapidly collecting fallen olives.

The appended figure shows the longitudinal section of the apparatus, as well as the upper surface of the handle. The device consists of a small board *D* bearing a number of points *F*, through which a lattice ejector *E*



REBUFFEL'S "Olive Gleaner"

works on pressing the lever *C* to the handle *B*. By means of the spring *R*, the ejector-lever takes up its former position on releasing the pressure. The spring *R*, whose pivot *G* is fixed to the handle *B*, is attached to the lever by a screw *Q*; the action of the spring is helped by the mortise *M*. The heads of the points *F* of the piece *D* are held in position by a plate *S*, placed under the upper board *D*; these two boards are fixed to the handle *B* by both back and front sides *K* and *U* respectively, leaving a hollow, *T*, between them. The ejector *E* is fixed on the lever by a screw *P* passing through its end and held by a wedge piece.

To use the apparatus, it is taken in the hand, the points turned towards the soil. The olives are collected by striking them from above downwards, when they are pierced by the points. When the points are full of olives, the apparatus is held over a basket, and on pressing the lever, the ejector moves up and removes the olives, which fall into the basket. If there are great numbers of fallen olives, the workman may use a second apparatus for the left hand.

89 — The "Alpha" Apparatus for the Discovery of Metallic Objects in the Soil. — *Le Génie Civil*, Vol. I,XXI; No 19, pp. 312-313, fig. 2. Paris, November 10, 1917.

From the data of M. GUTTON, who devised a machine for tracing projectiles buried in the soil, M. CHANOIT, Engineer, of Villeneuve-Saint-Georges, has constructed a new "Alpha" apparatus (so called because of its A-shape), by means of which a 75 shell buried 16 to 20 ins. in the soil may be located.

By means of the apparatus, any metallic object weighing 22 lbs and buried up to 20 ins. deep in the soil may be located.

The apparatus, based on the principle of the HUGHES induction balance, consists of 4 exploring coils wound two by two round two horizontal plates or circles of wood of 24 in. diameter and suspended at the ends of two wooden arms inclined at 45° towards the soil, and held firm by a cross member. The parts are all jointed. The centres of the plates are about 59 ins. apart, so that the apparatus controls a distance of about 82 ins. The regulating device is placed on the angle formed by the two inclined arms; it includes two enclosed coils, connected to the two rolls of wire fixed on the plates. Ordinary telephone receivers, carried by a telephonist's cap, are used as detectors.

A pile of 2 or 3 elements and a Ruhmkorff coil with a trembler provide the current. Both induction coil and pile are contained in a portable box, and joined to the exploring apparatus by long wires. Such as it is at present, the apparatus indicates the presence of a metallic mass buried about 20 ins. in the soil by means of the resonance of the telephone. As yet, such objects can only be discovered at a slight depth, but experiments are being carried out to increase its efficiency.

The instrument is light and easily handled, being entirely constructed in wood. It can be partly unmounted and folded to assist its transport.

## 90 — Review of Patents.

### *Tillage Machines and Implements.*

Canada	177 938. Harrow.
France	484 471. Device adjusting automatically the beam in the fore-carriage of a double brabant plough.
Netherlands	2 205. Sugar cane stalks covering plough.
Switzerland	72 283. Tractor plough.
United-Kingdom	109 340. Cultivator.
	109 446. Cultivating implement (motorplough).
	109 618. Plough (for mechanical traction).



- United States 1 239 559 — 1 240 047 Tractor ploughs.  
 1 239 627. Harrow tooth.  
 1 240 087 — 1 241 530. Gang ploughs.  
 1 240 542. Rotary harrow.  
 1 241 033 — 1 241 064 — 1 243 203 — 1 244 165. Harrows  
 1 241 046. Rotary wheel-harrow.  
 1 241 094. Method for renewing wornout plough points.  
 1 241 173. Tilling machine.  
 1 241 382. Cultivator.  
 1 241 774. Flexible disc harrow.  
 1 241 775. Flexible frame harrow-cultivator.  
 1 242 128. Cleaning attachment for harrows.  
 1 243 072 — 1 243 833 — 1 244 274. Ploughs.  
 1 243 758. Subsoil and grubbing plough.  
 1 244 016. Harrow and truck.  
 1 244 295. Seat attachment for riding harrows.

*Irrigation.*

- United States 1 239 692. Water elevator.

*Manures and Manure Distributors*

- United-Kingdom 109 575. Manure distributor.  
 109 671. Fertilisers (Process for manufacture of organic fertilisers).  
 United States 1 242 705. Manure spreader.

*Drills and Seeding Machines.*

- Canada 178 013. Grain box for drills.  
 178 014. Foot cup for drills.  
 United States 1 239 599. Device and method. of preparing seed beds.  
 1 240 227. Seed planter.  
 1 240 529. Potato planter.  
 1 242 061. Fertilizer-distributor and planter.  
 1 243 541. Maize planter.  
 1 243 560. Grain drill.

*Various Cultural Operations.*

- Canada 177 994. Weeder.  
 United States 1 239 945 — 1 243 970. Cultivators.  
 1 240 088. Combined ridger and blocker.  
 1 243 046. Cotton chopper or blocker.

*Control of Diseases and Pests of Plants.*

- Canada 177 928. Animal trap.  
 178 041. Insecticide.  
 France 484 796. Chemical preparation for the rational treatment of fungous diseases of plants.  
 United-Kingdom 109 060. Animal trap.  
 United States 1 239 501. Insect killer.  
 1 239 684. Boll-weevil destroyer.  
 1 240 736. Device for catching boll-weevils.  
 1 244 069. Animal trap.

*Reapers, Mowers and Other Harvesting Machines.*

- Canada 178 015. Harvesting machinery.

- France 484 560. Olive gleaner (1).  
 Switzerland 76 395. Motor mowing machine.  
 United-Kingdom 109 027 — 109 635. Reaping and mowing machines.  
 109 094. Swath turner.  
 109 116 Lawn mower.  
 109 250. Flax pulling machine  
 United States 1 239 570. Cutting apparatus for mowers.  
 1 239 614. Cotton harvesting and cleaning machine.  
 1 239 621. Adjusting mechanism for shocking machine.  
 1 239 685. Row-binder.  
 1 239 686. Lawn rake.  
 1 239 763. Hay rake attachment.  
 1 239 767 — 1 242 761. Cotton harvesters.  
 1 239 791. Grain binder deck.  
 1 240 028 — 1 241 490. Grain harvesters and binders.  
 1 240 128. Fruit picker.  
 1 240 161. Maize harvester and ensilage cutter.  
 1 240 361. Mowing machine.  
 1 240 424. Wind shield for harvesters.  
 1 240 847. Maize harvester.  
 1 241 096. Side delivery rake.  
 1 241 198. Harvester for cabbage and similar plants.  
 1 241 325. Ensilage harvesting machine.  
 1 241 452. Header attachment for tractors  
 1 242 112. Shocking machine.  
 1 242 240. Binder locking mechanism.  
 1 244 074. Swath divider for harvester.  
 1 244 152. Combined harvester and thresher.  
 1 244 341. Basket for lawn mowers.

\* *Machines for Lifting Root Crops.*

- United States 1 239 921. Potato digger.  
 1 239 935. Peanut and potato harvester  
 1 240 955. Beet harvester.  
 1 241 108. Root harvesting machine  
 1 241 761. Beet topping machine.  
 1 243 898. Potato-digging attachment for ploughs.

*Threshing and Winnowing Machines.*

- United States 1 239 922. Potato separator.  
 1 240 999. Bean separator.  
 1 241 028. Threshing machine.  
 1 241 045 — 1 243 284 — 1 243 528. Grain separators  
 1 241 980. Recleaner structure for the threshing machine.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Switzerland 72 284. Device for regulating the fermentation in stacked fodder and particularly in hay-stacks.  
 United States 1 239 871 — 1 241 548 — 1 241 981 — 1 241 035. Hay presses.  
 1 240 935. Elevator for silos.  
 1 242 812. Hay stacker.

See description and illustrations of No. 88 of this *Review*. (Ed.)

- 1 243 570. Automatic binder attachment for hay presses.  
1 243 754. Tamping device for silos.

*Traction and Steering of Agricultural Machinery.*

- United-Kingdom 109 960. Motor tractor.  
United States 1 239 603. Cushion spring for 3 wheeled tractors.  
1 240 338 — 1 240 488 — 1 240 650 — 1 240 761 — 1 240 782 — 1 241 034 —  
1 241 617 — 1 241 766 — 1 242 555 — 1 243 184 — 1 243 598.  
Tractors.  
1 240 758. Plough draw-bar head and leveler for tractors.  
1 241 446. Variable speed gearing for the reels of agricultural machinery.  
1 243 019. Tractor implement controlling mechanism.  
1 243 414. Tractor attachment for automobiles.  
1 243 704. Plough hitch mechanism.

*Housing of Livestock.*

- United-Kingdom 109 865. Horse shoe.  
United States 1 240 437. Hog feeder.  
1 241 495 — 1 243 127. Hog oilers.  
1 243 689. Feed-trough.

*Poultry Farming.*

- Switzerland 76 398. Incubator.  
United States 1 239 637. Brooder.  
1 243 707. Regulator for incubators.

*Bee Keeping.*

- United States 1 239 536. Bee shipping package.

*Industries Depending on Plant Products.*

- Canada 177 934. Flour mixer.  
178 405. Paste production.  
Netherlands 2 176. Process for manufacturing a dried food product from wastes  
of potato-flour mills.  
2 185. Apparatus for extracting potato-flour from a concentrated juice.  
United Kingdom 109 693. Drying tea.  
United States 1 239 555. Process of treating rice and products thereof.  
1 244 038. Fruit slicing machine.  
1 244 219. Flour mill machinery.  
1 244 429. Drying room for cereal pastes.

*Dairying.*

- Switzerland 76 322. Device for cleaning cream separator bowls.  
76 323. Churn.  
76 481. Butter making apparatus.  
United-Kingdom 109 471. Apparatus for drying milk, etc.  
109 589. Centrifugal separator.  
109 638. Milk sterilizing apparatus.  
United States 1 239 471. Milk powdering machine.  
1 239 923. Milking machine. teat-cup.  
1 240 765. Milking machine.  
1 243 788. Cheese shelf.

*Farm Buildings and Equipment.*

Canada	178 381. Wire stretcher and splices.
United States	1 240 135 — 1 244 220 Silos
	1 243 829. Silo-door

*Various*

United-Kingdom	109 907. Rotary pump
	109 961. Centrifugal pump
United States	1 241 305. Horse collar.

## RURAL ECONOMICS.

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ECONOMICS

91 — **The Milk Producer's Problem in the United States.** — GILLETTE, I. S. (Iowa State College), in *Hoard's Dairymen*, Vol. LIV, No. 11, pp. 324. Fort Atkinson, Wis., October 5, 1917.

There is no industry which is suffering as severely in the present crisis as that of milk production, while one-fifth of the total food supply of the United States is the dairyman's task.

The accompanying table shows the average price which the dairy farm operated by the Iowa State College was compelled to pay for feeds during the years July 1, 1914, to June 30, 1915, and July 1, 1916, to June 30, 1917, as well as the market quotations of the same feeds August 1, 1917. It shows that in the two year interval the price of feeding stuffs has increased from 70 to 205 %, as in the case of corn. Alfalfa hay is not quoted, but it will reach the highest price this winter to which it has ever soared. The problem of the dairyman, therefore, seems to be the utilization of feeding stuffs that have increased 100 to 200 % in cost for production of dairy products that are selling for only 25 % more than formerly.

Dairy farming has never been noted for large returns; its popularity is based upon the certainty of the income, usually at a small profit. Now, the great increases in the cost of production brought about largely by the rise in cost of labour, increased value of cows and price of feeding stuffs transform the profit to a loss. The relief must be sought principally in :

- 1) Higher prices for product.
- 2) Elimination of the boarder cow.
- 3) Economical selection of concentrates

Of these factors the first one is of primary importance and will be achieved through education of the consumer and organization of the producer. The second factor determines the degree of profit of the dairyman regardless of the price received for the product. A too large percentage of boarder cows will make any dairy a financial liability. The last factor is one which varies rather widely with the locality, season and year. While roughages are much more expensive than formerly they are still the cheapest source of food nutrients. In those herds which are kept for commercial milk production the more limited use of concentrates is the practical policy to pursue. Silage is a cheaper source of energy for all kinds of dairy stock than alfalfa and no dairymen with even a small herd can afford to be without it because of its succulence, palatability and economy.

*Prices of feeding stuffs per cwt.*

Feed	July 1, 1914 June 30, 1914	July 1, 1916 June 30, 1917	August 1, 1917	% increase
Corn meal . . . . .	\$ 1.525	\$ 2.25	\$ 1.65	205
Bran . . . . .	1.1375	1.73	2.65	132
Cottonseed meal . . . . .	1.50	2.10	3.00	100
Oil meal . . . . .	1.48	2.28	3.25	119
Ground oats . . . . .	1.156	2.24	2.60	124
Gluten feed . . . . .	1.35	1.86	3.15	133
Unicorn . . . . .	1.60	—	2.75	71
Alfalfa hay . . . . .	0.80	1.20	—	185
Corn silage . . . . .	0.175	0.30	0.50	—
Dried beet pulp . . . . .	1.25	—	—	—

92 - Economic Relations between the Tractor and the Farm. — See No. 80 of this Review.

## AGRICULTURAL INDUSTRIES.

93 - Methods for Determining the Adulteration of Wines. — PRATOLONGO, UGO, in *Le Stazioni Sperimentali Agrarie Italiane*, Vol. I., Pt. 6-7-8, pp. 315-361. Modena, 1917.

The chief methods for determining the adulteration of wine are examined separately.

The essential condition which any such method must fulfill is that it must be possible to distinguish clearly between natural and adulterated wines so that the dividing line includes *all* the natural wines and *these* wines only. Up to the present no method has been found fulfilling this double condition; each of them, while answering to one of the conditions, sacrifices the other more or less.

In order to determine the true value of the various methods the author examined 560 natural Italian wines, using analytical data supplied by the publications of the Italian Ministry of Agriculture.

The author gives a table on which are 2 curves interpreting the various methods examined, the alcohol content of the wines being represented by the abscissae and their acidity expressed as grammes of tartaric acid per litre, by the ordinates.

GAUTHIER'S *method*. — The total alcohol + sulphuric acidity must exceed a minimum value, fixed by Gauthier at 13, and reduced by the French Committee of Arts and Manufactures, to 12.5, and fixed at 12.5 and 11.5 for table wine and Aramon wine respectively by the French official methods. Expressing the alcohol content of the wine by  $g$ , its acidity, expressed as grammes of sulphuric acid per litre, by  $a_s$ , and the constant whose value is equal to 12.5 by  $C$ , the following formula is obtained:  $g + a_s > C$ .

This method includes *all* natural wines (of 560 natural wines only one appeared adulterated), but does not include *only* these wines (20 % of method).

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HALPHEN'S *method*. — This is expressed by the formula

$$a_s > 1.160 - 0.07 g$$

(the letters having the same signification as above).

Placing this formula in the form  $a_s > 1.160 g - 0.07 g$ , the maximum acidity would be obtained with  $g = 8.28$ . As this has in no way been proved the author considers the rule to have no rational basis.

Contrary to that of GAUTHIER this rule fulfills the just condition (the inclusion of *all* the natural wines) very imperfectly, but better satisfies the second (the inclusion of these wines *only*). In the experiments made,  $\frac{1}{5}$ th. to  $\frac{1}{6}$ th. of the natural wines wrongly appeared adulterated.

The author tried whether the modification introduced by POSSETTO and ISSOGLIO, and later by GALEAZZI (i. e. the introduction into the calculation of the ratio acidity : alcohol of the limit 0.120) really improved the results obtained. The diagram appended to the paper shows that HALPHEN'S rule thus modified answers the first condition, but no longer answers the second satisfactorily.

BLAREZ' *method*. — BLAREZ has given in table form the minimum acidity corresponding to each degree of alcohol by dividing natural wines into 5 categories and giving to each a dividing line between natural vines and adulterated wines.

The author's diagram shows BLAREZ' method to answer the double condition much better than the others, because it excluded the smallest quantity of natural wines and reduces to a minimum the possibility of not discovering adulteration.

ROOS' *method*. — This may be expressed as follows: — the total *alcohol + acidity* is in inverse proportion to the ratio *extract : alcohol*. According to ROOS, this coefficient is always below 25.6 in natural wines, but never below 24 in adulterated wines.

This rule has about the same value as that of GAUTHIER.

CONCLUSIONS. — BLAREZ' method is the most satisfactory, although applied without modification to Italian wines it would allow too much adulteration. It must be placed within closer limits.

Taking his diagram as a basis, the author divides natural wines into 2 categories according to their composition. The first includes the greater number of natural wines, which the author arbitrarily calls "wines of normal composition". The second includes nearly all the natural wines not contained in the first (58 out of 560 in the author's experiments, i. e., about  $\frac{1}{10}$ ) and called "wines of abnormal composition". The figures fixing the limits of the 2 categories of natural wines are given in 2 tables.

In order to apply these methods, all Italian wines of non-declared origin may be placed in the 1st. category. The wines of the second category could only be used commercially with a declaration of origin which would justify their abnormal composition. Wines of a composition below the limits fixed by the second category should be considered adulterated unless proof to the contrary can be furnished.

1st. category Wines of normal composition		2nd. category Wines of abnormal composition	
Alcohol content	Tartaric acid minimum	Alcohol content	Tartaric acid minimum
8	15.30	6	12.70
8.5	10.30	6.5	10.30
9	8.40	7	8.80
9.5	7.10	7.5	7.50
10	6.00	8	6.40
10.5	5.30	8.5	5.70
11	4.90	9	5.10
11.5	4.60	9.5	4.50
12	4.40	10	4.10
12.5	4.20	10.5	3.80
13	4.10	11	3.60
13.5	4.00	11.5	3.50
14	3.90	12	3.50
14.5	3.90	12.5	3.50
15	3.90	13	3.50
		13.5	—
		14	—
		14.5	—

94 — The Use of Horse-Chestnuts for the Production of Alcohol (1). — KAYSER, in *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 45, p. 10. Paris, November 6, 1917.

The author (Director of the Fermentation Laboratory of the National Agricultural Institute) gives the following figures for the content of the horse-chestnut in carbohydrates and nitrogen, comparing them with those of maize and rye.

Description	Composition per cent		
	Moisture	Nitrogen	Carbohydrates
Fresh undecorticated horse-chestnuts . . . .	49.2	4.8	40.9
Dried " " " " . . . .	18.8	6.9	53.7
Fresh decorticated " " " " . . . .	51.0	3.9	39.2
Dry " " " " . . . .	10.5	7.2	71.8
Average maize . . . . .	13.0	9.9	69.2
Average rye . . . . .	13.4	11.5	69.5

The horse-chestnut has an average content of 0.5 % of potassium and 0.15 % of phosphoric acid, foods necessary to alcoholic fermentation.

Experiments carried out by the author show that the yield of 27 to 28

(1) On the use of horse-chestnuts, see: — R. October, 1917, No. 954; R. December, 1917, No. 1185. (Ed.)

litres of alcohol per 100 kg. of dry horse-chestnuts, although inferior to that of maize, is sufficiently high, in view of the moderate cost of the chestnuts (12s. 8d. per 100 kg. of dry nuts), to justify their use for making alcohol in war time.

- 95 — **Utilisation of Acorns by Acoholic Fermentation.** (1). — KAYSER, in *Feuille d'Informations du Ministère de l'Agriculture*, Year 22, No. 19, pp. 9-10. Paris, December 4, 1917.

The author (Director of the Fermentation Laboratory) describes the results obtained by the alcoholic fermentation of sweet acorn juice.

The experiments were carried out with three varieties of oak, pedunculate, sessile and holm, found in the Mediterranean district. Whole acorns and kernels were used. The sweet liquid was obtained by treating the acorns (without the cups), cut into small pieces with twice, and sometimes four times, their weight of water in the presence of 2.5 % of hydrochloric acid or 1 % of sulphuric acid during half an hour in the autoclave at 120-122°C. The sweet liquid is filtered off, the solid residue being crushed in a mortar and treated with hot water till the liquid is completely extracted. The liquids are neutralised with potash up to an acidity of 1 % in sulphuric acid.

Either grain or cider yeast was added to the sterilised liquids. Fermentation usually started after 24 hours, rather more rapidly in flasks to which had been added from 1 to 2 % of sweet rye extract (nitrogenous and phosphatic food), more rapidly also in those of greater dilution, which is comprehensible, for an excess of tannin, of which acorns contain a fairly large proportion, prevents alcoholic fermentation.

Grain yeast gives a yield slightly higher than that obtained with cider yeast.

The yield from whole acorns varies from 8.58 to 20.16 litres of alcohol per 100 kg. of dry material, whereas for the kernels, it may amount to as much as 28, 29 or 31 litres. This yield is higher than that obtained by the author for horse-chestnuts, although, in a certain sense, these fermented more easily (2). The yield varies with the degree of ripeness, the variety, and, above all, the dilution (influence of the tannin).

It is best to use dry acorns, freed from their cups by threshing and sifting.

- 96 — **Unsalted Lime Bread.** — See No. 3 of this *Review*.

- 97 — **The Problem of Sugar Manufacturing in India.** — WYNNE, SAYER, in *The Agricultural Journal of India*, Vol. XII, Part. IV, pp. 550-565. Calcutta, October, 1917.

After a thorough examination of the problem of the Indian Sugar Industry in its different aspects, the writer, summing up his various points of view, makes the following statement: The problem of the Indian Sugar Industry is a two-fold one, and energetic measures should now be set

(1) On the use of acorns as a food for cattle see No. 66 of this *Review*. — (2) See No. 94 of this *Review*. (Ed.)



on foot to place both the *gur* and the white sugar industries on a satisfactory working basis. To do this properly will require a survey to be made of the localities where white sugar factories can be erected, and at the same time the districts where the cane cultivation is only capable of carrying a *gur* factory should be carefully recorded. The financial side of the matter and the question of State assistance to the pioneer factories also require to be carefully examined.

To do this will require a strong committee of experts who will also be able to report to Government how far the manufacture of sugar on a considerable scale together with its by-product — alcohol — can be made the subject of excise control in India. The question of the creation of a special sugar department for India for tackling and coordinating the numerous manufacturing, agricultural, botanical and chemical problems connected with the industry could also be dealt with, but the main question is to get it dealt with at once, for, at present, Indian sugar is being made under most favourable conditions and this state of things, which gives an insight into the possibilities of the industry in India, when foreign competition is lacking or curtailed, will not last for long, and if the industry, which is now in places getting its head above water, is allowed to be stifled again by unfair competition, it will not readily respond to efforts made in the future to resuscitate it.

98 — **The Manufacture of Sugar in the Republic of Salvador.** — See No. 46 of this *Review*.

99 — **The Utilisation of Grape Residue as Fuel.** — MATIGNON, C. and MARCHAL, G., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 21, pp. 718-721. Paris, November 19, 1917.

A thermal study of grape residue showed it to have about the same value as peat as a fuel. Its thermal constants, chemical composition and ash content, are exactly similar to those of peat. There is no doubt that it might be used, like peat, in suitable stoves. Experiments on this subject will shortly be carried out with the residues from the last harvest.

In a normal average year, with a French production of 50 million hectolitres of wine, it would be possible to obtain, after distillation, residues having a calorific value equivalent to more than 160 000 metric tons of coal.

100 — **Celery Storage Experiments.** — THOMPSON, H. C., in *United States Department of Agriculture, Bull. No. 579*, pp. 26, 10 figs., 17 tables. Washington, September 5, 1927.

Celery growing is of great importance in the United States. The farm value of the crop in 1909 was \$ 3 922 848, but, as a considerable portion of this is stored for one to three months, its commercial value is much superior to the farm value given.

This value may be increased by good storage methods. The old methods are gradually being given up more and more in favour of cold-storage. In spite of this, celery is so difficult to store that many warehouses prefer to devote themselves to other products.

Very few data on the cold storage of celery are available. The expe-

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periments carried out by the United States Department of Agriculture during period of four years, 1912-1910, aimed at determining :

- 1) The factors which hasten decay in celery in storage houses.
- 2) The best methods of reducing the loss of celery in storage due to decay and mechanical injury.
- 3) The best type of crate in which to pack celery to be cold-stored.
- 4) The effect of the temperature of the storage room on the keeping quality of celery.

The experiments were carried out in three cold-storage warehouses, Elmira, Hornel and Williamson, N. Y.

Large crates are favourable to decay, which begins in the centre. Injury to the celery is chiefly due to the breaking of the crates.

The celery suffered less injury when packed in smaller crates and in those with a longitudinal or transversal ventilation partition down the centre. The 14 inch crate gave the best results, followed by the 16 inch crate and the 11 inch crate. The standard crate varies in size from 22 to 24 by 24 inches. Small crates, though slightly more expensive than large ones, are preferred by many cold-storage warehouses because it is easier to handle them and the proportion of broken crates is smaller.

A market test showed that celery stored in small crates sells for a much higher price than that in standard crates handled in exactly the same way.

The crates were piled up in five tiers. The celery in the top tier was decayed in a larger proportion than that in the lower tiers.

There was a greater difference in the keeping quality of the celery in the different tiers in standard crates than in the other crates.

The difference in the keeping quality of the celery in the different tiers is probably due to the difference in temperature of the room at different heights. The temperature of the air at the fifth tier averaged 2.4° F. more than that of the first tier. The temperature of the celery in standard crates averaged 2.7° F. higher at the fifth tier. The temperature of the celery in the standard crate averaged 2° F. higher than in the partition crate and 4.1° higher than the air at the same height.

In order to check properly the temperature of the room, thermometers should be placed at different heights. In many cases when the temperature at 4 feet from the floor was 32° F., that near the ceiling was found to be from 35 to 39°.

101 - The Cost of Cattle Foods in the United States, from 1914 to 1917. — See No. 91 of this *Review*.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

102 - New Japanese Fungi (1). — TANAKA, TYOZABURO, in *Mycologia*, Vol. IX, No. 6, pp. 364-368. Lancaster, Pa., November, 1917.

GENERAL

This third note gives an English translation of the systematic descriptions, originally published by the authors in Japanese, of the following new species of fungi.

1) *Massaria moricola* I. Miyake n. sp. (published in December, 1916), common on twigs of *Morus alba* in the following localities: — Gifu-ken (prefecture), Kaidzu-gun Kaisaimura (1909); Fukui-ken (pref.); Ōno-gun and Hida-no-kuni (Gifu prefecture), Mashita-gun, Shimohara-mura (1909); Nagano-ken (pref.), Shino-ina-gun (1910); Tokyo-fu (pref.), Nakano-chō (1915); Tochigi-ken (pref.), Utsunomiya-shi and Fukushima-ken (pref.), Fukushima-shi (1915); Kyoto-fu (pref.); Ayabe-chō (1915).

2) *M. japonica* I. Miyake n. sp. (December, 1916); not common, on twigs of *Morus alba* in the following localities: — Gifu-ken (pref.), Ena-gun Kashimo-mura (1909); Iwate-ken (pref.); Hanamaki-chō (1915).

3) *Mycosphaerella Hori* K. Hara n. sp. (March, 1917) on leaves of *Citrus*; type localities: — Hamana-mura, Inasa-gun, Shidzuoka-ken (1914), Katarō, Shimidzu; Japanese name of disease: Kashaku "Ko-maruboshiyō"; Dr. SHÔTARÔ HORI considers the cause of this disease to be *Phyllosticta curvatispora* Hori n. sp.,; as no description of the fungus is given it is impossible to determine whether it is a form of *Myc. Hori*, but the existence of such a relationship is very probable; according to HORI the fungus mostly attacks the navel variety of *C. sinensis* and *C. nobilis* var. *unshiu* (Unshu [Satsuma] orange);

4) *Phyllosticta citricola* Hori, n. sp. (published in July, 1913, without description, and published again in March, 1917); on leaves of *Citrus*; type localities: — Toyoda-mura, Abe-gun, Shizuoka-ken (1914); Japanese name of disease: — "Kasshoku Ō-maruboshiyō"; the same disease is reported to have caused great injury to the Japanese summer orange ("Natsudaidai") in the province of Toyoda-gun (Hiroshima-ken), and also in Abe-gun, Shidzuoka-ken; HORI reported it as also attacking *C. nobilis* var. *unshiu*.

(1) See also R, Oct., 1917, No. 965. (Ed.)

103 — **New or Noteworthy North American Fungi.** — DEARNESS, J., in *Mycologia*, Vol. IX, No. 6, pp. 345-364. Lancaster, Pa., November, 1917.

The list includes 51 species of fungi either new or worthy of note, collected at different times in various districts of North America. A systematic description is given of the numerous species new to science.

Special mention should be made of the following: —

- 1) *Asterina (Asterella) fumagina* Dearn. and Barth., n. sp., on living leaves of *Panicum latifolium*, Maricao, Porto Rico;
- 2) *Phacidium Gaultheriae* Dearn., n. sp., on living stems of *Gaultheria Shallon*, Vancouver Island;
- 3) *Exoascus Aceris* Dearn. and Barth. n. sp., on living leaves of *Acer grandidentatum*, Parley's Canyon, Utah;
- 4) *Cicinnobolus major* Dearn. and Barth., n. sp., on *Oidium* on living leaves of *Grindelia squarrosa*, Billings, Mont.;
- 5) *Septoria samarae-macrophylli* Dearn. and Barth., n. sp., on green samarae of *Acer macrophyllum*, Duckabush River, Wash.;
- 6) *Sept. Sarcobati* Dearn. and Barth., n. sp., on the calyx of *Sarcobatus vermiculatus*, Tromberg, Month.;
- 7) *Melasma Menziesiae* Dearn. and Barth., n. sp., on living leaves of *Menziesia ferruginea*, Duckabush, Wash.;
- 8) *Gloeosporium Ailanthi* Dearn. and Barth., n. sp., on living leaves of *Ailanthus glandulosa*, Shreveport, La.;
- 9) *Gl. Bartholomaei* Dearn., n. sp., on living leaves of *Ribes bracteosum*, Port Orchard, Wash.;
- 10) *Gl. Betae* Dearn. and Barth., n. sp., very injurious to sugar-beet leaves, Billings, Mont.;
- 11) *Gl. Crataegi* Dearn. and Barth., n. sp., on living leaves of *Crataegus brevispina*, Vancouver, Wash.;
- 12) *Marssonina bracteosa* Dearn. and Barth., n. sp., on living leaves of *Ribes bracteosum* attacked by *Gl. Bartholomaei*, Port Orchard, Wash.;
- 13) *Septogloeum Nuttallii* Hark., on living leaves of *Osmaronia cerasiformis*, Vancouver Island;
- 14) *Sept. Schizonoti* Dearn., n. sp., on living leaves of *Schizonotus discolor*, Vancouver Island;
- 15) *Sept. Salicis-Fendlerianae* Dearn. and Barth., n. sp., on living leaves of *Salix Fendleriana*, Caldwell, Idaho;
- 16) *Cylindrosporium Artemisiae* Dearn. and Barth., n. sp., on living leaves of *Artemisia Suksdorfii*, Pleasant Beach, Wash.;
- 17) *Fusoma rubricosa* Dearn. and Barth., n. sp., on living leaves of *Calamagrostis scabra*, Glacier National Park, Mont.;
- 18) *Ramularia Clematidis* Dearn. and Barth., n. sp., on living leaves of *Clematis ligusticifolia*, Billings, Mont.;
- 19) ? *Cercospora Aceris* Dearn. and Barth., n. sp., injurious to living leaves of *Acer macrophyllum*, Duckabush, Wash.;
- 20) ? *C. Alni* Dearn. and Barth., n. sp., injurious to leaves of *Alnus rubra*, Bremerton, Wash.;
- 21) *Cercospora Streptopi* Dearn. and Barth., n. sp., on living leaves of *Streptopus amplexifolius*, Duckabush River, Wash.

104 - **Rust Resistant Manitoba Wheat, in France.** — See No. 34 of this *Review*.

105 - **Vines Offering a Relative Resistance to Mildew.** — SALOMON, RENÉ, in *Revue de Viticulture*, Year 24, Vol. XLVII, No. 1220, pp 314-316. Paris, November 15, 1917.

A list of French vines is given which, in any kind of year, give a full harvest, and which, even in 1917, were perfectly immune to mildew of the fruit with four sprayings only.

I. **WHITE GRAPES.** — “Meslier Saint-François” or “Meslier du Gâtinais”; “Meslier hâtif”, too well known to require description.

“Meslier rose”, less productive than “Saint-François”, yielding as much as 1 780 gallons per acre of a colourless wine which keeps excellently, but more productive than “Meslier hâtif” with an equivalent choice table wine.

These three varieties are easily protected however violent the attack may be. They are closely followed by :

“Aubin blanc” (Lorraine), late 1st. period. Strong and of regular yield (short pruning). At Euvezin (Meurthe-et-Moselle) this plant has given extraordinary harvests.

“Bouquetriesling”, “Feinriesling”, “Firnriesling”, “Goldriesling” 1st period. Obtained from OBERLIN (Alsace). Strong and fertile. First cultivated in Auvergne experimentally, are now gradually grown over an increasingly large area, especially “Goldriesling” (medium pruning)

Next come the following, which are also easily protected :

“Ezer Jo”, early 2nd. period, very fertile. Enormous yield. Very fine appearance (short pruning).

“Fernand rose” (OBERLIN), early 1st. period. Very heavy yield (short pruning). Mixed vat and table wines.

“Gros Pinot blanc hâtif”, 1st. period, vigorous and fertile. Selection of “Pinot blanc Chardonnay”. The most resistant of all “Pinots blancs” to oidium (long pruning).

“Putzcheere”, early 2nd. period, called, on account of its extraordinary fertility “Aramon du Nord”, strong plant (short pruning).

“Sylvaner blanc”, late 1st period. Heavy yield of a light, sweet, pleasant wine (short pruning).

“Tantovina”, 2nd. period. Very heavy yield. Wine identical with that of “Meslier du Gâtinais” (short pruning).

“Traminer rose”, late 1st. period, in great demand in Alsace, where it produces excellent wine (long pruning).

“Weisser Klœvner” or “Pinot blanc vrai”, 1st period, Alsace, excellent quality wine (long pruning).

II. **RED GRAPES.** — “Lasca”, 1st. period, adapts itself to almost all exposures; very good wine; very resistant to rot (ample pruning).

“Magyar Traube”, early 1st. period, heavy yield, mixed vat and table (cordon pruning).

“Patte d’oie”, 1st. period, good plant, regularly fertile (short pruning).

These are closely followed by :

“Gamay teinturier supérieur”, 1st. period; yield equivalent to that of “Fréau”, but wine less acid, and flowing differently (medium pruning).

"Gougenot", late 1st. period, shoots open fairly late, gives a light, very refreshing wine (medium pruning).

"Limberger", late 1st. period gives an abundance of good table wine (long pruning).

"Melascone nera", late 2nd. period, "Pinot" to be recommended for its fertility and the superior quality of its wine (long pruning).

"Pinot noir Saint-Laurent", late 1st. period, "Pinot" giving a yield double that of the best selected "Pinots"; excellent quality wine, resistant to black rot (long pruning).

"Pinot Renevey amélioré", 1st. period, selection of "Pinot noir", but with a heavier yield (long pruning).

MEANS  
OF PREVENTION  
AND CONTROL

DISEASES  
OF VARIOUS  
CROPS

106 — **Patents for the Control of Diseases and Pests of Plants.** — See No. 95 of this *Review*.

107 — **Observations on Hemp Mildew (*Peronoplasmopara cannabina*) in Italy.** — PEGLION, VITTORIO, in *Rendiconti delle sedute della Reale Accademia dei Lincei*, Classe di Scienze fisiche, matematiche e naturali, Vol. XXVI, Pt. II, pp. 618-620. Rome, 1917.

Repeated observations on the presence and behaviour of "hemp mildew" carried out for about ten years in the province of Ferrara, confirm the fact that, except in rare cases, this parasite is practically of no importance. Nevertheless the great frequency with which it is found in the very conspicuous form of conidial fructifications, lead the author to study it anew.

He found the first spots on plants which had already put forth their third and fourth stages of leaves. These spots were fairly large and not accompanied by deformation of the leaves of the first node, and were often confined to a longitudinal portion of the leaflet, which curves over in the form of a scythe when the leaves of successive nodes are infected. If the young plants showing signs of mildew on the first leaves are carefully pulled up and put in very damp and dark surroundings, large efflorescences of conidiophores form in 24 hours, even on the upper stages of the leaves. Only after some hours does the part occupied by the conidiophores show signs of chlorosis and turn brown.

If, on the other hand, the plants are left under their normal conditions of growth, these abundant fructifications of the parasite only occur on the leaves already infected. If the plants are left 3-4 days under these environmental conditions, a microscopic examination shows the presence of oospores in the brown, mildewed tissues, which form a source of decay. Oospores form very rapidly on loose mildewed leaves kept in a damp room but in limited numbers.

Oospores form regularly in the seed leaves, even under normal environmental conditions. On all the plants showing mildew spots on the cauline leaves, a microscopic examination of the remains of the cotyledons showed the presence of oospores and of a thick efflorescence of conidio-

phores. This implies that infection of the young plant takes place dur-

ing germination. Infection experiments were carried out with conidia on pot cultures of hemp immediately after germination. Three or four days later the cotyledons of a fairly large number of the young plants were covered, on both sides, with a thick brown efflorescence formed of conidiospores of the parasite.

The presence of a papilla at the extremity of the conidia made it appear probable that the fungus in question had been wrongly placed in the genus *Peronospora*; and, indeed, close observation of the germination of the conidia showed them to behave like true zoosporangia. In order to follow their development young hemp plants germinating under glass were used. Conidia were sown in the drops of water which had condensed on the cotyledons, and, at the same time, conidia were sown in drops of distilled water in the usual damp rooms. In both cases, after a period of time varying from one to two hours, the protoplasmatic contents begin to divide, the papilla at the end disappears, and well-defined zoospores, which move rapidly within the conidial wall, slip through the narrow opening made at the end of the conidia; each conidium usually produces three very motile zoospores with two flagella. One or two hours after they have emerged, they become immotile, lose their flagella, become spheroid with differentiation of a thin wall, then develop a single or branched germination tube, which moves along the epidermis to the nearest stomate.

The dichotomous ramification of the conidiospores and the germination of the papillate conidia by zoospores shows the parasite of hemp to resemble "melon mildew", which has been moved from the genus *Plasmopara* (*Pl. cubensis*) by BERLESE, who proposes to class it, with *Pl. celididis*, in the sub-genus *Peronoplasmopara*. ROSTOWZEW, without taking BERLESE's observations into account, created the genus *Pseudoperonospora* in order to bring out the characteristics of this fungus, but, as has been observed by CLINTON, the sub-genus *Peronoplasmopara* deserves precedence both on account of priority of publication and its well-defined characters. The parasite of hemp therefore no longer belongs to the genus *Peronospora* and must be placed in the genus *Peronoplasmopara* (*Peronoplasmopara cannabina* [Oth.] Pegl.).

108 - The "Irish Gold" and "Broad Leaf Burley" Varieties of Tobacco Attacked by *Thielavia basicola*, in Ireland. — See No. 49 of this Review.

109 - Black Rot Disease of Tea. — PERCH, T., in *Department of Agriculture, Ceylon, Leaflet* No. 2, pp. 3, 2 figs., Colombo, Ceylon, February, 1917.

In two districts in the low country a new disease of tea has recently appeared. This disease, commonly called black rot disease, appears chiefly on the leaves, but it may attack all the aerial parts of the plant.

Attention is usually drawn to the affected bushes by the blackening of the young leaves; the more tender ones at the tops of the shoots turn black, soft and rotten. The chief characteristics of the disease are the persistence of hanging dead leaves and the occurrence of dead leaves united in clusters of two or three, or joined to the stem by a mycelium.

The fungus causing the disease — *Hypochnus* sp. of the Thelephoraceae

family — consists of very fine threads, usually invisible to the naked eye, which spread along the stems and under surface of the leaves, to which they are generally confined, giving off branches which penetrate into the living tissues of the plant and kill them. It does not appear to cause any damage on the old stems, but on the young ones it causes premature hardening in the form of scaly grey-brown patches.

On the young leaves the fungus produces small blackish-brown or chocolate-brown spots, which run into one another and form a patch which gradually extends over the whole surface. The action of the fungus is not so general on the old leaves, only part being attacked as a rule.

The disease passes from the stalk to the leaf by means of the leaf stem, but healthy leaves may be infected by contact with diseased ones.

The disease usually occurs in patches scattered over the field. There is reason to believe that the fungus is an inhabitant of the Ceylon jungle and spreads from the jungle to the tea. On one infected estate it was found on an isolated group of jungle shrubs, on Gurukina (*Calophyllum Burmanni*) and Iramusu (*Hemidesmus indicus*).

Infection experiments on tea at Peradeniya have, so far, failed completely. This does not mean that the fungus will not attack tea at Peradeniya or greater heights.

The *Hypochnus* may be found to be still alive on prunings left in the field at least two months after pruning.

As the fungus lives on the stems and branches, diseased plants must be pruned well back, and, since it continues to live on the prunings, these must be removed and burnt. As, also, the parasite may still exist on the older stems, the pruned bushes must be well sprayed with Bordeaux mixture.

110 — A Disease of the Hemlock Tree. — MURRILL, W. A., in *Journal of the New York Botanical Garden*, Vol. XVIII, No. 213, p. 208, Lancaster, Pa., September, 1917.

A disease of the hemlock tree (*Tsuga canadensis*) caused by *Fomitiporia tsugina* Murrill was discovered by Mr. PERCY WILSON at East Hebron, New-Hampshire, in August, 1905.

In July, 1917, Mr. WILSON again visited the district and collected specimens of the fungus from the trunk of the same tree, which he found dead and lying on the ground.

Living hemlocks near Bristol, New Hampshire, examined by Mr. WILSON, were also found to be attacked by the fungus, which exists in New York as well as in New Hampshire, attacking only the hemlock tree.

The disease is probably important and should be studied by foresters as well as by mycologists.

## WEEDS AND PARASITIC FLOWERING PLANTS

111 — The Destruction of Weed Seeds by Carp, in Ricefields. — See No. 8 of this *Review*.

112 — The Eradication of Tall Larkspur (*Delphinium exaltatum*), a Poisonous Weed of Cattle Ranges in the U. S. National Forests. — See No. 55 of this *Review*.





- 113 - The Control of "Cogon Grass" (*Impera exaltata*), a Grass Favouring the Incubation of Locusts, in the Philippines. — See No. 53 of this Review.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

- 114 - Scolytid Beetles Observed in Oregon (United States). — CHAMBERLIN, W. J., in *The Canadian Entomologist*, Vol. XLIX, No. 9, pp. 321-328; No. 10, pp. 353-356. London, 1917.

GENERAL

The following beetles have been observed in Oregon at different times :

- 1) *Conophthorus ponderosae*, Hopk., collected at Corvallis;
- 2) *Conophthorus* sp. : 3 adults bred from cones of *Pinus contorta* collected at Corvallis;
- 3) *Cryphalus amabilis* n. sp., made small chambers in many branches of *Abies amabilis* near Elk Lake; the trees looked sickly and the foliage of many branches was turning red;
- 4) *C. subconcentralis*, Hopk., collected at Astoria;
- 5) *C. grandis* n. sp., abundant on *A. amabilis* near Corvallis;
- 6) *Crypturgus* sp., working in the dead bark near the top of a dead fir (*Abies lasiocarpa*) near Sumpter;
- 7) *Dendroctonus valens*, Lec., rather common throughout the pine regions of Oregon; especially abundant in *P. ponderosa* in Eastern and Central Oregon; occasionally found at the base of the larger specimens of *P. contorta*; noted at Corvallis, Hood River, Bend, Crescent, Sumpter, Sparta, Ashland and on the Kilamath Indian Reservation;
- 8) *D. monticolæ*, Hopk., found throughout the State on *P. ponderosa*, *P. contorta*, *P. monticola* and *P. Lambertiana*; it has caused heavy losses in North-Eastern, Central and Southern Oregon;
- 9) *D. engelmanni*, Hopk., this species has not before been recorded from this State; the writer collected 2 dead adults from their characteristic mines under the bark of *Picea engelmanni* near Sumpter in the Blue Mountain Region of North-Eastern Oregon;
- 10) *D. brevicornis*, Lec., this is the most serious pest of pine in Oregon and causes the death of a very large amount of the largest and finest pine (*P. ponderosa*) timber of Eastern, Central and Southern Oregon; thousands of dollars are expended annually in combating the pest;
- 11) *D. pseudotsugae*, Hopk., found in all parts of the State where *Pseudotsuga taxifolia* grows; the beetles seem to prefer injured or fallen timber, but will attack living healthy trees, as is shown by a serious infestation in South Washington and near White Pine, Oregon, where several thousand trees were killed;
- 12) *D. obsesus*, Mannh., a rather rare beetle working in the cambium of *Picea sitchensis*; at Marshfield and Astoria;
- 13) *D. jeffreyi*, Hopk., this species is reported by HOPKINS as occurring in South-West Oregon; the writer, however, has seen no species working in this State
- 14) *Dolurgus pumilus*, Mannh., on *Picea sitchensis*;
- 15) *Dryocoetes autographus*, Ratz., a number of specimens referred to this species were collected near Detroit from the bark of large Douglas fir (*Pseudotsuga taxifolia*) windfalls;
- 16) *Dryoc. pseudotsugae*, Swaine, not uncommon in the western part of the State; found at Ranier in hibernation galleries in the outer bark of *Pseudotsuga taxifolia*, and under the bark of the same conifer near Olney; also noted at Corvallis and Detroit;
- 17) *Eccoptoraster unispinosus*, Lec., widely distributed in the State, works in *Larix occidentalis*, *Pseudotsuga taxifolia*, and *Picea Engelmanni*; it often causes the death of saplings;
- 18) *Eccoptogaster* n. sp., resembles *unispinosus* in size and form; found in the twigs of a dying *Abies grandis* at Corvallis;
- 19) *Eccopt. subscaber*, Lec., found throughout the State working in *Abies* and especially in *A. grandis*;

- 20) *Gnathotrichus sulcatus*, Lec., common in dying trees, especially in the Western portion of the State. Collected from *A. grandis*, *A. nobilis*, *Pseudotsuga taxifolia* and *Tsuga heterophylla*; noted at Corvallis, Detroit, Astoria, and in the Blue Mountain region;
- 21) *Gn. retusus*, Lec., found on *Ts. heterophylla*, *Pinus contorta*, *P. ponderosa* and *Pseudotsuga taxifolia*; most abundant in the Coast Range and Blue Mountains;
- 22) *Gnathotrichus* sp., on *Alnus oregona* at Florence;
- 23) *Gnathotrichus* sp., on *Acer macrophyllum* at Corvallis;
- 24) *Hylastinus obscurus*, Mannh., a common clover root-borer found in both Eastern and Western Oregon;
- 25) *Hylesinus aculeatus*, Say., not abundant, but bores galleries in *Fraxinus oregona* in the Western valleys of the State; under the synonym of *Leperisinus aculeatus* Lec., a specimen has been found on an unknown host plant at Corvallis;
- 26) *Hyl. aspericollis*, Lec., a rather common species attacking living and dying alder trees (*Alnus oregona*); it usually selects young individuals, but the writer collected a number of adults from old trees near Breitenbush Hot Springs; noted also at Florence and Corvallis;
- 27) *Hyl. granulatus*, Lec., on *Abies grandis* in the Blue Mountains;
- 28) *Hyl. dentatus*, Lec., rare, on *Juniperus occidentalis*;
- 29) *Hyl. imperialis*, Lec. rare, at Corvallis;
- 30) *Hylurgops rugipennis*, Mannh. under the bark of a large dead white pine (*Pinus monticola*) in Santiana national Forest;
- 31) *Hyl. subcostulatus*, Mann., a decided secondary pest entering dying or dead *Pinus ponderosa* after other Scolytids have started their work; especially numerous in this conifer in the Blue Mountain region.
- 32) *Hyl. lecontei*, Swaine, on *P. ponderosa* and *P. contorta* in the Eastern portion of the State, and in the coast variety of *P. comorta* near the mouth of Siuslaw River;
- 33) *Ips emarginatus*, Lec., attacks the cambium of the lower and middle trunk of *P. ponderosa* and *P. contorta*; it excavates large mines often cutting through those of *Dendroctonus valens*, *D. monticolae* and *D. brevicornis* and attacks living, dying and recently dead trees, both standing and fallen;
- 34) *Ips* n. sp., collected from a *Pinus ponderosa* (which had been dead at least 2 years) at Hood River;
- 35) *I. latidens*, Lec., on *P. ponderosa* on Boundry Creek, Grant County;
- 36) *I. radiata*, Hopk., not uncommon in *P. contorta* and *P. ponderosa* in the Blue Mountain Region of Eastern Oregon; collected under bark of drying *P. contorta* in Whitman National Forest;
- 37) *I. rectus*, Lec., reported from Oregon by LECONTE;
- 38) *I. oregona*, Hopk., abundant in galleries in *P. ponderosa*, especially in recently felled trees, at Bend and Ashland;
- 39) *I. pini*, Lec., reported from Oregon by LECONTE;
- 40) *I. interruptus*, Eichl., a single specimen taken from *Picea sitchensis* at Marshfield;
- 41) *I. interpunctatus*, on *Pinus contorta* in the Whitman National Forest;
- 42) *I. concinnus*, Mannh., this species ordinarily attacks *P. contorta* and *Picea sitchensis*; some adults were, however, taken from a fire-injured sapling of *Pseudotsuga taxifolia* at Astoria this was probably an accidental host;
- 43) *I. caelatus* var., on *Picea Engelmanni*, in Grant County;
- 44) *I. confusus*, Lec., on *Pinus*, in the extreme south part of the State;
- 45) *Orthotomicus ornatus*, Swaine, on *Pinus ponderosa* in the Whitman National Forest;
- 46) *Phloeosinus dentatus*, Say., a single example collected from *Chamaecyparis nootkensis*, at Elk Lake;
- 47) *Ph. punctatus*, Lec., found doing considerable damage to *Juniperus occidentalis* in the vicinity of Bend and Prineville, in Central Oregon; galleries of this beetle were also found in *Libocedrus decurrens* on the Klamath Indian Reservation. It has been taken from its galleries

<sup>i</sup>n *Thuja plicata*, *Chamaecyparis nootkatensis* and *Ch. Lawsoniana* in the Western part of the State; the cocoons of an unidentified hymenopterous parasite were found in the mines made by the beetle in *Juniperus*;

43) *Ph. cristatus*, Lec., rare, attacks *Chamaecyparis nootkatensis*, *Abies nobilis* and *Picea Engelmanni*;

44) *Ph. sequoiae*, Hopk., on *Thuja plicata* and *Sequoia sempervirens* in the Southwestern portion of Oregon;

50) *Pseudohylesinus nebulosus*, Lec., particularly on living, dying or felled individuals of *Pseudotsuga taxifolia*; observed in both Eastern and Western Oregon;

51) *Ps. nobilis* Swaine, on *Abies nobilis* in the Cascade Mountains;

52) *Ps. laticollis*, Swaine, found with the above species on *Abies nobilis* and also on *A. lasiocarpa*;

53) *Pseudohylesinus* n. sp., taken in the act of boring into a Lebanon Cedar (*Cedrus Libani*) at Corvallis;

54) *Pseudohylesinus* (an undescribed species allied to *nebulosus* Lec.) taken at Elkington;

55) *Ps. griseus*, Swaine, less common than *Ps. nebulosus*, but in habits, life history, etc., it is very similar; found attacking *Pseudotsuga taxifolia* at Breitenbush Hot Springs in the Cascade Mountains;

56) *Ps. sericeus* Mannh., very similar to the last 2; bred in numbers from *Pseudotsuga taxifolia* collected at Corvallis, Astoria and Detroit, Oregon;

57) *Ps. sericeus* var., bored from *Pseudotsuga taxifolia* at Corvallis.

58) *Pityokiates jasperi* Swaine; two specimens on *Abies grandis* and *A. lasiocarpa*, near Sumpter;

59) *Procryphalus aceris*, Hopk., on *Acer macrophyllum* at Albany;

60) *Tomicus (Hylastes) nigrinus* Mannh., on *Pseudotsuga taxifolia* at Corvallis, Ranier, Astoria and Svensen;

61) *Pityogenes carunculatus* Lec., found attacking living, dying and felled yellow pine (*Pinus ponderosa*) at Bend;

62) *Pityophthorus pubipennis*, Lec., abundant on *Fraxinus oregona* and *Quercus Garryana* in the Western Valleys;

63) *P. puncticollis*, occasionally met with in *Picea sitchensis* and *Pinus contorta*;

64) *P. confusus* Lec.; according to SWAINE, this species is found in Washington and California, so it undoubtedly occurs in Oregon, but the writer has never collected it there;

65) *P. confusus*, Swaine; bred from pine cones collected at West Port, Oregon;

66) *P. nitidulus*, Mannh., a widely distributed species found in dying *Pinus Picea* and *Pseudotsuga*, throughout the State;

67) *Pityophthorus* n. sp., a species similar to *nitidulus*, collected many times from *Abies grandis* in the valleys and from *A. nobilis* in the Cascades;

68) *Trypodendron (Xyloterus) lineatus*, Oliver, from Seaside;

69) *Tryp. (Xyl.) politus*, Say, a single specimen bearing label "Huntingdon Oregon", probably wrongly labelled;

70) *Try. rufitarsis*, Kirby, on *Pinus Contorta* near Sumpter,

71) *Trypodendron* n. sp., near *rufitarsis*, collected on living *Pseudotsuga taxifolia* at Breitenbush Hot Springs;

72) *Xyleborus dispar* Fabr., in orchard trees, at Portland, Salem, Corvallis, Oregon City and Eugene;

73) *Xyleborus xylographus*, Say on *Quercus Garryana* and *Pseudotsuga taxifolia* at Corvallis;

74) *Platypus wilsoni*, Swaine, found on *Abies grandis* at Corvallis; *A. nobilis*, Elk Lake; *Tsuga heterophylla*, Detroit; *Pseudotsuga taxifolia*, Corvallis and Ranier.

- 115 - *Sphinx convolvuli* in England in the Autumn of 1917 (1). — CLARKE, W. J., in *The Naturalist*, No. 731, p. 308. London, December, 1917.

In the autumn of 1917 an immigration of the *Convolvulus Hawk Moth*, was observed in the Scarborough district. The author saw specimens of this moth captured at Scarborough on August 22nd. and September 3rd. 10th. and 12th., together with two others obtained in September, the exact date being unknown. Another specimen was captured at Scalby on August 31st.

- 116 - On the Parthenogenetic Reproduction of *Otiorrhyncus sulcatus*, a Coleopteron Injurious to the Vine, in France. — FETTAUD, J., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. 165, No. 22, pp. 767-769. Paris, 1917.

Up to the present the vine weevil (*Otiorrhyncus sulcatus* Fabr.), well known in France for the damage it does to the vine, was considered as having normal sexual reproduction.

The serious attacks made by it in recent years in the Saint-Pierre d'Oléron vineyard (2) gave the author, during the years 1914 to 1917, an opportunity of studying many specimens of this weevil both under natural conditions and in captivity. Among thousands of individuals examined, some of which showed the external characteristics considered proper to the male, the author found none but females.

In May 1917, 50 weevils, collected at the beginning of the season, laid fertilised eggs which gave live larvae, although all the weevils were found to be female.

These observations show the coleopteron in question, like *O. turca* Bohem., *O. cribricollis* Gyll., and *A. ligustici* Linn., to be reproduced generally, if not constantly, by parthenogenesis, thereby adding a fourth species to the three parthenogenetic ones already known. This species is the most common and most harmful of those found in France.

The fact is of great importance from a practical point of view. Since all, or nearly all, the individuals are females, and each lays more than 150 eggs, the annual production is very large in favourable environmental conditions, and the centres attacked spread very rapidly if energetic measures to destroy the pest are not taken.

It is probable that males do exist, but they are doubtless very rare, appearing only sporadically in certain generations.

The parthenogenesis of *O. sulcatus* and its three above mentioned allied species, must be placed, provisionally at least, in the type of irregular parthenogenetic cycle, although the existence of males still remains to be definitely proved.

#### RESISTANT PLANTS

- 117 - A Note on Resistance to Black Scale in Cotton. — HARLAND, S. C., in *West Indian Bulletin*, Vol. XVI, No. 3, pp. 255-256. Bridgetown, Barbados, 1917.

Certain varieties of cotton plant are immune to attack from black scale (*Saissetia nigra* Nietn.). In 1914 many Seredo cottons were introduced into St. Vincent, and showed great differences in their susceptibility to

(1) See also R.-Dec. 1917, No. 1251 — (2) See on this subject B. Nov., 1914, No.



black scale. Two types, remarkable for their resistance, were isolated and cultivated, and, in the following year still showed the same immunity. One of them, carefully studied for three generations, never showed any trace of black scale though the other varieties were badly attacked. The immunity of certain types of cotton is, then, a fixed and transmissible character.

Hybridisation experiments were carried out with the Seredo, a naturally immune variety, and the Sea Island variety, which is very susceptible. The hybrids were quite uniform in their morphological characters, and were almost completely immune to black scale, only a few scattered specimens of the insect being found.

Immunity, therefore, behaves as a partial dominant.

118 - Natural Enemies of *Chrysomphalus dictyospermi*, a Coccid Injurious to Citrus (1). — MALENOTTI, ETTORE, in *Redia*, Vol. XIII, Pt. 1, pp. 17-53, pl. 1-2. Florence, 1917.

MEANS OF  
PREVENTION  
AND CONTROL

The following are mentioned as natural enemies of the coccid *Chrysomphalus dictyospermi* Morg.:

1) a fungus, *Cladosporium* sp., often found in Calabria and Sicily, inside and outside the insect; its importance as a parasite of the coccid has not yet been shown;

2) the mite *Allothrombidium gymnoptorum*, preying actively on the insect in question, on *Diaspis pentagona* Targ. and other *Diaspinae*; it is of no agricultural importance;

3) the native predatory coleoptera: a) *Chilocorus bipustulatus*, L., easily seen on trees attacked by *D. pentagona*, *Aspidiotus hederæ* Vall., *Saissetia oleæ* Bern., and which may also be found on trees attacked by *Chr. dictyospermi*; it is prevented from spreading by the endophagous hymenoptera *Tetrastichus epilachnæ* (Giard.) and *Homalotylus flaminus* (Dalm.); this coleopteron, which has never seriously impeded the development of *D. pentagona* or *Chr. dictyospermi* in Italy, is of great importance in Spain where, in the province of Valencia, a decrease of this last coccid in the orange-groves, corresponds to a great increase of the coleopteron; b) *Exochomus 4-pustulatus* L., which, like the previous one, has three generations each year; c) *Cybocephalus rufifrons* Reitter;

4) the following imported predatory coleoptera: a) *Rhizobius lophantæ* Blaisé; b) *Rhiz. ventralis*; c) *Orcus calibaens*; these have not yet been proved to be of practical importance in the destruction of *Chrys. dictyospermi*.

Then follows a description of 7 chalcid hymenoptera, three of which belong to the sub-family *Eulophinae* and are endophagous:

1) *Aspidiotiphagus citrinus* (Craw.) How., which attacks many species of *Diaspina*, among which are *Aonidia lauri* (Bouché), *Aonidiella aurantia* var *citrina* (Coq.), *A. perniciosæ* (Comst.), *Aulacaspis pentagona*

(1) See also *B. April*, 1911, No. 1312; *B. April*, 1915, No. 451; *B. October*, 1915, No. 1102; *R. July*, 1916, No. 827; *R. August*, 1916, No. 948; *R. October*, 1916, No. 1140; *R. Nov.* 1916, No. 1245; *R. January*, 1917, No. 110. (Ed.).

(Targ.), *A. rosae* (Bouché), *Aspidiotus hederae*, *A. betulae* Baer., *A. destructor* Sign., *Chrysomphalus ficus* Ashm., *Chrys. dictyospermi*, *Hemichionaspis aspidistrae* (Sign), *H. minor* (Mask.), *Lepidosaphes beckii* (Newm.), *Leucaspis signoreti* Targ., etc., but, in Italy at least, the host in which it is most frequently found is *A. hederae*; one of its varieties — *Aspidiotiphagus citrinus* var. *agilior* Berl. — breeds in abundance from *Chionospis euvyni* Comst.; the value of this variety in the control of Diaspinae is not to be despised; in limited areas it sometimes succeeds in checking *A. hederae*, as was the case in the olive orchards of Liguria; but its action is too uncertain for it to be considered always as a means of controlling *A. hederae*; it proved no less efficacious against *A. destructor* on coconuts in the island of Tahiti; *A. citrinus* has been found in *Chrys. dictyospermi* in America since 1904; recently the author found it in the same insect living on *Sansevieria arborescens* in the greenhouses in the Italian Colonial Agricultural Institute at Florence; later, from the coccid of the same *Sansevieria* plant, the author obtained a new *Prospaltella* (*Pr. fasciata*); the percentage (97 %) of *Chrys. dictyospermi* attacked, attributed entirely to *A. citrinus*, must be considered as representing the total action of the two chalcids; it has so far been impossible to determine how much of this total is due to each of the two species; it appears that the proportion of female *Chrys. dictyospermi* attacked by *Pr. fasciata* is fairly high;

2) *A. lounsburyi* Berl. and Paol., does not attack *Chrys. dictyospermi* only; the author also found it in large numbers in *Fiorinia florinae* Targ., on an undetermined plant from Madeira, and at the end of June, 1916, it was found in fairly large numbers on *Diaspis boisduvali* Sign. living on leaves of *Vanilla aromatica* and also, a few days later, on *Hemichionaspis aspidistrae* on a fern of the genus *Nephrolepis*, both in the greenhouses of the Torrigiani garden, at Florence; as regards the value of this chalcid in the control of *Chrys. dictyospermi*, not only were 50% of the specimens of this scale sent by LOUNSBURY from S. Africa attacked, but also scales of other species sent to Florence from Madeira seemed to be attacked by it in large proportion; for this reason it is being distributed by the Royal Station of Agricultural Entomology of Florence.

3) *Prospaltella fasciata* Malen., obtained, as already stated, from *Chrys. dictyospermi* on *Sansevieria arborescens* in the greenhouses of the Italian Colonial Agricultural Institute of Florence with *Aspidiotiphagus citrinus*.

The other four chalcids described belong to the ectophagous species.

1) *Aphelinus chrysomphali* Mercet (sub-family *Eulophyinae*), found by MERCET on *Chrys. dictyospermi* from Spain; the description given by the author is based on two females obtained from *Chrys. dictyospermi* on citrus material sent for study from Spain (Alicante and Palma de Mallorca) and on 70 other females from *Aonidiella aurantii* (Mask.) from gardens in Greece; whereas, according to MERCET this *Aphelinus* is of little practical importance in the control of *Chrys. dictyospermi*, it is very efficacious against *Aon. aurantii* living on lemons and cedrates in Greece (Calamata, Corfu, some islands of the Aegean Sea); in this country it has been noticed that the smell of unburied manure placed under the cedrate tree keeps *Aphelinus*

away, thus allowing *Aonidiella* to multiply; dust which covers the foliage of the trees planted along a road has the same effect.

2) *A. silvestrii* De Greg., the author's description is based on the examination of one female only, obtained near the Royal Station of Agricultural Entomology at Florence from *Chrys. dictyospermi* on orange leaves sent from Palermo by Marquis DE GREGORIO, whose favourable opinion on the practical value of this *Aphelinus* for destroying *Chrys. dictyospermi* is not borne out by observations made at Florence; from many hundreds of the coccid sent by Marquis DE GREGORIO, only one specimen of *Aphelinus* was obtained, and from material, sent by Prof. T. DE STEFANI, also from Palermo, and including fresh leaves of orange, maple and ivy, only two female chalcids were obtained, both from *Chrys. dictyospermi* from maple leaves.

3) *Signiphora merceti* Malen. (sub. family Encyrtinae); two females obtained at Florence on *Chrys. dictyospermi* from Spain, and one female obtained from *Hemiberlesia camelliae* on Robinia from Pietrasanta (Lucca); according to the author this chalcid is not of great importance as a natural enemy of *Chrys. dictyospermi*.

4) *Aphicus hesperidum* Mercet (sub-family Encyrtinae); two male specimens obtained from *Chrys. dictyospermi* from Spain; there is little hope that this chalcid will play a great part in the control of *Chrys. dictyospermi*.

119 - *Phora fasciata*, a Dipterous Parasite of the Coleopteron *Coccinella septempunctata*, in France. — DU BUISSON, H., in *Bulletin de la Société Entomologique de France*, No. 15, pp. 249-250. Paris, 1917.

In July 1912, the author collected in the department of Allier pupae of *Coccinella septempunctata* L., fixed as usual on the upper part of the vine leaves. After having kept them in a small box for a long time, he noticed that one was deformed, and that, near the shreds of leaves near it, were small pupae from which minute diptera had emerged.

In June, 1917, the author again collected in the same department pupae of *C. septempunctata* fixed, well in evidence, on potato leaves, and put aside 37 specimens in perfect condition. Of these, 33 emerged normally towards July 12th., but the 4 others were deformed, and near them, on the leaf on which they lay, were again dipterous pupae. These were placed for observation in a tube and the perfect insect emerged after July 12th.

DR. J. VILLENEUVE, who examined the dipterous, identified it as *Phora fasciata* Fallén, adding that RONDANI (*Atti Soc. ital. Sc. nat. Milano*, II [1860], p. 165) had already published a note describing this species as a parasite of the pupae of *C. septempunctata*.

120 - *Sycosoter lavagnei* n. g. and n. sp., a Hymenopterous Parasite of the Coleopteron *Hypobarus ficus*, Injurious to the Fig Tree, in France. — PICARD, FRANÇOIS and LICHTENSTEIN, JEAN L., in *Bulletin de la Société Entomologique de France*, No. 16, pp. 284-287, figs. 1-3. Paris, 1917.

The breeding-out of the scolytid *Hypobarus ficus* Erichs, from the branches of the fig-tree, at Montpellier, gave a braconid parasite described here

as a genus and species new to science under the name of *Sycosoter lavagnei*.

This insect is an external parasite of the larva of *Hyp. ficus*. The egg is placed on the host through the bark of the fig tree. The larva spins a cocoon in the gallery of the scolytid for pupation. It appears that *Syc. lavagnei* has as many generations as *Hyp. ficus*. The spring females of the hymenopteron are almost all winged; those of the autumn are chiefly apterous. Winged males seem rarer than apterous ones, even in spring.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

121 - *Phytoecia cylindrica*, a Coleopteron Injurious to Carrots, in Sweden. --

KEMNER, N. A., in *Meddelande No. 139 från Centralanstalten för Försäkränsändel* Jordbruksomr del, *Entomologiska Afdelningen*, No. 26, pp. 1-8, fig. 1-8. Stockholm.

In the autumn of 1915, the cerambycid *Phytoecia cylindrica* L. ("Stjälkbocken") was reported to be damaging seed carrots near the Stockholm Agricultural Experiment Station.

The larvae of the insect, at a certain distance above the soil, enter the stalk and bore within it long galleries down to the roots, thus preventing the normal development of the plant. The insect influences not only the quantity of seed produced, but also the quality. In the case in question the percentage of seeds capable of germinating fell as low as 30.

This insect is found in the north of Sweden, as far as Stockholm, and in Västmanland. It is also fairly common in Norway and Finland.

122 - *Rhagoletis pomonella*, the Apple Maggot, or Railroad Worm, an Injurious Dipteron Recorded for the First Time in British Columbia, Canada (1). --

TREHERNE, R. C., in *The Canadian Entomologist*, Vol. XLIX, No. 10, pp. 329-330. London, 1917.

Two adult flies of *Rhagoletis pomonella* Walsh (fam. *Trypetidae*) were taken by the writer near Penticton (British Columbia), on July 16, 1916. The fact is interesting, for this is practically the first time this insect, which attacks apples, has been recorded in the province of British Columbia, and it is practically the first time that it has been mentioned as occurring on the Pacific Coast of North America.

The flies were taken on the Red Astrachan variety of apple, but examination of its fruit and those of other early varieties in the vicinity on July 26th. and again in August, revealed no definite sign of larval injury. Many early varieties of apple had been picked and shipped at the time of this second examination. Consequently, this fact, coupled with the lateness of the season, which was towards the end of the flight period of the adults, probably accounts for the paucity of material.

As regards the distribution of this species of fly on the Pacific coast, 5 specimens were collected by O. T. BARON in the southern part of California, and described by SNOW in 1894 as *Rhagoletis zephyria* n. sp. R. W. DOANE in 1908, and J. M. ALDRICH in 1909, stated that *R. Zephyria* is a synonym of *R. pomonella*. Since the record of 1894, apparently this insect has not been observed again in California.



According to information furnished to the writer by ALDRICH, the insect has been recorded from the eastern slope of Colorado (Colorado Springs, Fort Collins).

No information is available that the species exists in the State of Oregon, but A. L. MELANDER states that it has been recorded as destructive along the eastern border of the State of Washington. He remarks, however, that there is no positive evidence of its occurrence in Washington orchards.

Consequently, the record for British Columbia is almost unique for the Pacific Coast. Evidently the insect is not yet numerous in British Columbia, otherwise its presence would have been observed before. Even yet, no definite form of larval injury has been observed, and the record, thus far, exists only in the form of the capture of 2 adult flies. It is interesting to note, however, that E. H. STRICKLAND captured a single specimen of this fly at Lethbridge (Alberta) in 1914. These are little doubt that the insect emerged from imported fruit, and as the Province of Alberta is supplied more commonly with western fruit than with eastern, the record suggests an interesting probability.

123 - *Stomacoccus platani* n. gen., and n. sp., A Coccid Observed on *Platanus racemosa* in California. — FERRIS, G. F., in *The Canadian Entomologist*, Vol. XLIX, No. 11, pp. 375-378 + figs. 36-39. London, November, 1917.

This paper gives a systematic description of the new genus *Stomacoccus* and the new species *St. platani* together with information on the biology of the coccid.

The insect was found in California on leaves, branches and trunk of *Platanus racemosa* (sycamore) at Pasadena, Stevens Creek (Santa Clara County) and near Stanford University.

124 - Cynipidae Observed on *Castanopsis* spp. and *Quercus* spp. in America. — BEUTENMULLER, WM., in *The Canadian Entomologist*, Vol. XLIX, No. 10, pp. 345-349. London, October, 1917.

This paper gives a systematic description of the following gall-forming hymenoptera :

1) *Andricus castanopsidis* n. sp., on flowers of western chinquapin (*Castanopsis sempervirens* and *C. chrysophylla*), in the following districts of California : Pacific Grove (Monterey County), Truckee, Mount Tamalpais, Placer County ;

2) *A. myrtifoliae* n. sp. on flowers of *Quercus myrtifolia* at Jacksonville and Palatka (Florida) ;

3) *A. gemmiformis* n. sp. on the trunk of *Q. alba* in the district of Fort Lee (New Jersey), at Woodlawn (New York City), at Evanston (Illinois) ;

4) *A. dugesi* n. sp. at Guanajuato (Mexico) ; the gall produced by this species was not observed ;

5) *Biorhiza caepulaeformis* Beutenmuller, at the base of shoots of *Quercus rubra* at Evanston ;

6) *Amphibolips nigra* Beutenmuller, on branches of *Quercus* sp. at Durango (Mexico) ;

7) *Dryophanta floridensis* n. sp., on the trunk of Spanish oak (*Q. pigitata*) and Blue Jack (*Q. brevifolia*), at Ocala and Jacksonville (Florida).

[122-124]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

- 125 The Distribution in Wheat, Rice and Maize Grains of the Substance, the Deficiency of which in a Diet causes Polyneuritis in Birds and Beri-beri in Man. — CHICK, HARRIETTE and HUME, E. MARGARET, in *Proceedings of the Royal Society*, Series B. Vol. LXXX, No. B. 624, pp. 44-68. London, December 1, 1917.

RURAL  
HYGIENE

The experiments described were carried out at the Lister Institute, and the results obtained led to the following conclusions: —

Wheat endosperm, which constitutes white flour, is deficient in anti-neuritic vitamins (the substance whose deficiency in a diet causes polyneuritis in pigeons and beri-beri in man) (1); when fed to pigeons as an exclusive diet it caused polyneuritis in a manner identical with polished rice.

In both the wheat and rice grain, the anti-neuritic vitamin is concentrated mainly in the germ or embryo; it is present in less quantity in bran (pericarp and aleurone-layer), probably in the aleurone-layer. The embryo of maize grain also possesses marked anti-neurotic properties, both in the scutellum and in the plantlet. For this reason it is important to include the germ in the flour from which wheaten bread or biscuit is made, especially when the diet may consist largely of preserved foods, which are deficient in the vitamin.

The daily ration of wheat-germ that must be added to a diet of polished rice in order to prevent the onset of polyneuritis is equal to the amount which, administered by the mouth, will cure a pigeon acutely ill with polyneuritis, brought on by an exclusive diet of polished rice. This relation is not peculiar to wheat germ, but applies to other foodstuffs, such as yeast, containing anti-neuritic vitamins. The addition of wheat-germ to a diet of polished rice in quantity (3 gm. every second day) sufficient to prevent

(1) See R. Jan., 1918, No. 2, (Ed.).

polyneuritis, also maintained the weight and general health of the bird. Rations in excess of this (2 to 3 gm. every day) led to a great increase in body-weight and in the general well being and vitality of the birds.

Exposure of wheat embryo to a temperature of about 100° C. for two hours caused an insignificant loss in anti-neuritic vitamine; therefore, if it be included in the flour from which bread or biscuit is made, it can be relied upon to retain its anti-neuritic properties after baking.

At temperatures in the neighbourhood of 120° C., however, there was a swift destruction of anti-neuritic properties. This fact must be borne in mind in dealing with diets largely composed of preserved and tinned foods previously sterilised at temperatures above 100° C.

126 — Some Remarks on Macedonian Anopheles. — COT and HOVASSE, in *Bulletin de la Société de Pathologie Exotique*, Vol. X, No 10, pp. 890-896 Paris, December 12, 1917.

Macedonia, together with Greece, is the worst malarial district of Europe. The authors examined: — 1) the nature of Anophelines and their larvae; 2) their life cycle and the influences modifying it; 3) the percentage of Anopheline carriers of hematozoa. Their observations showed the following interesting points: —

The principal carriers of malaria in the Salonica district are *Anopheles maculipennis* and a special variety of *Pyretophorus superpictus* which it is proposed to call *P. macedoniensis*.

The life cycle varies greatly, especially the larval stage, and is largely dependent on the temperature. Contrary to the opinion generally held, an altitude of 1956 to 3260 feet (Mount Hortiack), as well as a decrease of 10° C. at night, are not sufficient to stop evolution. It seems that the Anopheles of Salonica are adapted to the great variations of day and night temperature characteristic of the country.

The proportion of Anopheles found to be infected was 8 %; they were found especially at Mikra where the cases of malaria were very frequent in proportion to those found elsewhere.

#### AGRICULTURAL EDUCATION

127 — Agricultural Education in the United States. — FORRITT, EDWARD, in *The Quarterly Review*, No 453, pp. 315-333 London, October, 1917.

The Department of Agriculture at Washington has been a department of first rank in the executive branch of the Government of the United States — a department presided over by a Cabinet Minister — since 1889. In these 28 years it has gradually acquired one outstanding distinction. With the single exception of the Post Office, it is to-day in more close and frequent touch with the hundred million inhabitants of the United States and it renders them more constant and direct service, than any other department of state at Washington.

This article is concerned only with the educational work of the Department of Agriculture. The simplest method of describing the work of Congress and of the Department on behalf of good agriculture and efficient farm economy is to take the budget of one of the state agricultural colleges, and show the connection of Congress and the Department with the 66 agricultural colleges and with the farm experiment stations associated with the

colleges, and the connection of the colleges and the Department with the vast scheme of educational extension work now being carried out under the Smith-Lever Act of 1914.

The budget of the agricultural college of the State of Illinois, for the year 1916-1917, shows that it received grants from the Federal Government towards the cost of its maintenance under three heads :

1) For the endowment of teaching in agriculture and the mechanic arts (MORRILL and NELSON funds) annually. . . . .	\$50 000 000
2) For investigation in agriculture (HATCH and ADAMS funds) . . . . .	30 000 000
3) For demonstration work in agriculture and home economics (SMITH and LEVER funds, 1916-17) . . . . .	58 184 030
Total . . .	\$138 184 030

In some states there is more than one agricultural college. The total number in 1917 was 66. In 1857 the first bill passed by Congress for aiding the state governments to establish colleges for the teaching of agriculture was vetoed by President BUCHANAN. The bill had been introduced by J. S. MORRILL, of Vermont. Four years later, after the election of LINCOLN, and of a new House of Representatives, MORRILL reintroduced his bill. A similar bill was introduced in the Senate; and in June 1862 there was enacted the law under which what have since been known as the Land Grant Colleges came into existence.

The Federal Government at that time had enormous areas of public land at its disposal; and, with money accruing from these lands, the agricultural colleges, now under the control of the state governments, were founded. By the Act of 1862 each of the then existing states received from the Federal Government a large donation of public land. Representation in the Lower House at Washington is based on population; and under the Morrill Act there was apportioned to each state an area of land equal to 30 000 acres for each senator and representative in Congress to whom the state was entitled by the apportionment under the census of 1860. As the lands so assigned were sold, the money accruing was directed by the Morrill Act to be invested in bonds of the United States or in state bonds. The money was to form a perpetual fund; and the interest accruing from it was to be applied to the support and maintenance of at least one college in each state,

"where the leading object shall be, without excluding other scientific and classical studies, and including military tactics, to teach such branches of learning as are related to agriculture and the mechanic arts, in such manner as the legislatures of the states may respectively prescribe, in order to promote the liberal and practical education of the industrial classes in the several pursuits and professions of life".

By the Morrill Act, and also by four subsequent Acts for aiding the states in promoting the teaching of agriculture, the cost of buildings for agricultural colleges has always been a charge on the states.

Over agricultural colleges established under the Morrill Act the Federal Government had no supervision or control. It was left to the state

legislatures to prescribe the course of teaching. There was no audit in the interest of the Federal Government, no examination, test or inspection to ascertain whether the Federal Government, as representing the people of all the states, was getting value for its money. All the duties of a state government to the nation outside its own borders in respect to its agricultural college, largely maintained by the Federal Government, had been discharged when copies of the annual report of the college, "recording any improvement and experiments made, with their costs and results", had been forwarded to the Secretary of the Interior at Washington, and also to all the other colleges endowed by the land grants of 1862.

Between 1862, when the Federal Government made possible an agricultural college in every state, and 1914, when the Smith-Lever Act was passed, three additional grants were made to the State agricultural colleges for the extension of their work. The first was in 1887. Congress then passed an Act providing for the establishment of agricultural experiment stations in connection with the agricultural colleges. A grant of \$15 000 a year was made to each state for the maintenance of an experiment station. The work to be undertaken was defined in the Act as follows :

"To conduct original researches or verify experiments in the physiology of plants and animals; the diseases to which they are severally subject, with remedies for the same; the chemical composition of useful plants at their different stages of growth; the comparative advantages of rotative cropping, as pursued under a varying series of crops; the capacity of new plants or trees for acclimation; the analysis of soils and water; the chemical composition of manures, natural or artificial, with experiments designed to test their comparative effects on crops of different kinds; the adaptation and value of grasses and forage plants; the composition and digestibility of the different kinds of food for domestic animals; the scientific and economic questions involved in the production of butter and cheese; and such other researches or experiments bearing directly on the agricultural industry of the United States as may in each case be deemed advisable, having due regard to the varying conditions and needs of the respective states or territories".

It was under this law of 1887 that, for the first time, the Department of Agriculture at Washington was brought into direct connection with the work of the agricultural colleges. The connection was effected by a section of the Act which directs that, in order to secure, so far as possible, uniformity of methods and results in the work of the experiment stations, it shall be the duty of the Secretary of Agriculture to furnish forms for the tabulation of the results of investigations or experiments; to indicate from time to time such lines of enquiry as shall seem most important to him; and in general to furnish such advice and assistance as will best promote the purpose of the Act.

A few years afterwards, the American Association of Agricultural Colleges and Experiment Stations was organised; and, chiefly at the instance of this association, Congress in 1906 increased the appropriation for each experiment station from \$15 000 to \$30 000 a year. Earlier than this — in 1890 — by the Nelson Act, an additional annual appropriation was made to each of the agricultural colleges. The net result of these Acts of Congress of 1862, 1887 and 1906, for the advancement of the teaching of agriculture,

was that in 1914 — the year before the Smith-Lever Act — each state was receiving from the federal treasury \$50 000 a year for its agricultural college, and \$30 000 for its experiment station.

Since in all this legislation the cost of the buildings at agricultural colleges and at experiment stations, with their maintenance and repair, is thrown on the state and all the state legislatures make annual appropriations for their colleges, it will be realised that this liberal expenditure in the interest of agriculture by federal and state governments has popular support.

In these years, before the United States Government made appropriations to the states for extension work, there existed in the Department of Agriculture a division which was exclusively concerned with the work at the State experiment stations. Its functions, which since the Smith-Lever Act came into operation have been taken over by the States Relation Service Bureau of the Department, were to carry out the provisions of the Acts of 1887 and 1906; to enable the Secretary of Agriculture to certify to the treasury department when federal grants might properly be paid to the state experiment stations; to report to Congress regarding the work and expenditures of the stations; and to aid the stations in the effective development of their work.

Inspectors from the bureau visit each experiment station at least once a year. Its work and its expenditure are carefully examined; and on the basis of reports made by these inspectors, warrants are issued on the United States treasury for the payment of the grants to the various states. Stations must submit their schemes of work to the Secretary of Agriculture, practically to the States Relations Services Bureau.

While the agricultural colleges were extending their work by means of the federal grants of 1887, 1890 and 1906, and of liberal appropriations from the state legislatures, larger appropriations were made by Congress to the Department of Agriculture, and its work was greatly extended. The appropriation for the Department for 1887-1888, the year in which Congress made its first grant to the colleges for experiment stations, was \$637 000. Ten years later, in 1898-1899, the appropriation had risen to nearly \$2 500 000. In 1908 it was nearly \$10 000 000; and for 1913-14, the year before the Smith-Lever Act came into operation, it was \$16 651 000.

With the enactment of the Smith-Lever law the Department entered on a new era. It began to have a direct, as distinct from an indirect part in what may be described as the popular teaching of agriculture and farm economy. From 1887 to 1914 its work for agricultural education was, in the main, done through the state experiment stations and by means of bulletins and reports sent through the post to farmers, cotton growers, grain growers, cattlemen, foresters and lumbermen, market gardeners, fruit growers, and poultry men. The most widely-circulated of the Department's publications is the "Farmers' Bulletin". The bulletins are written in plain language, and are adapted to the different sections of the country, 'their specific object being to tell farmers how and when to do things'; in 1914 in the aggregate 14 795 000 bulletins were sent through the mails. What are known as Department Bulletins are more specialised than the

Farmers' Bulletins. They are concerned with subjects of interest to fruit growers, truck growers (*i. e.* market gardeners), poultry men, and lumbermen. They are intended for men who are specialists, actively engaged in these various industries, and who, while not technical men, can be described as professional workers. Included in the Department Bulletins are what are known as Professional Papers, in which information on highly technical subjects is communicated to scientists or technologists in the same or allied fields of enquiry. These bulletins are issued in editions averaging six thousand copies. They are distributed free to applicants.

Purely scientific and technical subjects are handled in the "Journal of Agricultural Research", which is issued weekly, and is sent free to the agricultural colleges and experiment stations, and to technical schools and universities.

The "Experiment Station Record" is a technical review of the world's scientific literature pertaining to agriculture. Its free distribution is restricted to the staffs at agricultural colleges and experiment stations. The "Weekly News Letter" is a quarto sheet of four pages, three columns to a page. It contains news of the more important activities of the Department, with articles on farm practice and home economics. Its circulation is restricted to the employees of the Department in Washington and in the field, to crop correspondents, and to various agencies that cooperate in the work of the Department. The "Monthly Crop Report", distributed to all persons sufficiently interested to ask that their names should be placed on the mailing list, publishes data concerning current agricultural conditions. Its chief features are estimates of acreage, reports of conditions and statistics as to yields and prices. At the end of each month comes the list of publications. It gives a brief description of each publication issued during the month, and an indication of the region of the country to which it is adapted. It is by means of this list that miscellaneous applicants are enabled to keep in touch with the Department and to ask for those publications in which they are interested.

The duties and functions of the Department between 1887 and 1914 came to include much that might not inaptly be described as police work, chiefly in connexion with the administration of the federal pure-food code, the stamping-out of disease among cattle, and the eradication of insects and diseases that work havoc in the plant world. But it was chiefly through its supervision of the work of the state experiment stations and through its various widely-circulated publications, that the Department made its contribution to the propaganda for improved farming and better economic and social conditions in the farming communities.

For some years before the new era in the history of the Department, which began after the passage of the Smith-Lever Act, several of the larger agricultural colleges, with some help from semi-public organisations like the Rockefeller Foundation, or from chambers of commerce, or from state associations for the improvement of agriculture, had been engaged in extension work. The college faculties had organised itinerant schools for the teaching of agriculture. Not content with the work they were doing with



their four-year students or their short-course students they had sent their teachers into the rural communities, where they conducted schools for even as short a period as two weeks and then moved on to another community. In a considerable number of states county agencies had also been established. Graduates of agricultural colleges, after they had had two or three years of actual experience on farms, were, if suitable, appointed resident county agents at salaries from \$1200 to \$1800 a year, and commissioned to devote the whole of their time to visiting farms, instructing farmers in new and improved methods of work, and in improving the general farm economy of the counties in which they are placed.

Women graduates of the agricultural colleges who had specialised while at college in the care of poultry and in farm economy were similarly appointed, to devote their time to the education of the women of the farms in matters pertaining to farm home management.

It was found, as early as 1912, that this extension work by the agricultural colleges was highly appreciated in the farming communities of the states in the south and west in which it had been undertaken. It was perceived that this direct teaching was resulting in more efficient farming, and finally that it was obviously tending to make farm life more attractive to the boys and girls of the farms. It was also realised at Washington that colleges which embarked in this direct teaching of agriculture and farm economy should not be dependent on semi-public sources for the funds with which to carry it on, but that it was a mission in which the Department of Agriculture should have some part, and over which the Department should have some supervision, as since 1887 it has had over the State experiment stations.

Under the Smith-Lever Bill a grant of \$10 000 a year is made to each of the states for extension work, and a second grant, based on the rural population of the state, is made subject to the condition that a corresponding grant for extension work is made by the state legislature. For the year 1916-17 the total grant was \$1 580 000. Each year until 1921 the grant will be increased; and, when the maximum is reached, a little over \$5 250 000 a year from the federal treasury will be available as the contribution of the Federal Government towards the cost of the extension work of the state colleges of agriculture.

The Bill proposed to set up a system of general demonstration teaching throughout the country, while the agent in the field of the Department and the college was to be the mouthpiece through which this information was to reach the people — the man and woman and the boy and girl on the farm. The plan proposed undertook to educate the farmer by personal contact — by going on to his farm, under his own soil and climatic conditions, and demonstrating that there are methods which in results surpass his own.

The problems with which the Department of Agriculture and the teachers of agriculture and farm economy are confronted are various. Among these are the one-crop areas; the large proportion of farmers who are owners of the land they cultivate, but make a poor living and have little money at their disposal; the chronic shortage of labour in all farming communi-

ties; the large number of farms in the hands of new-comers from European countries who cannot read English; and the large areas in the southern cotton-growing states, where tens of thousands of small plantations — one-mule farms — are rented by negroes.

The Smith-Lever law came into operation in the fiscal year 1914-15. Some details of its working were given to the committee of agriculture of the House of Representatives by Mr. C. B. SMITH, chief of the Office of Extension Work, one of the subdivisions of the States Relation Service Bureau of the Department as follows: —

“The department and the college employ a state leader who is in charge of all county work. The state leader selects the county agent, inaugurates and directs his work, subject to the approval of his superior officers, who are the director of the Extension Service and the director of the States Relation Service in the department at Washington. The state leader has to find men who understand the science of agriculture and the practice of agriculture. He takes graduates of the colleges who have remained in the state, and who have made a success in the practice of agriculture. He takes the agent down to the county where he is to be employed, and lets the people look him over, and see whether or not he is acceptable to them. His employment is the joint action of the county, the state, and the Department of Agriculture. The county agent's business is to bring to his county everything that is appropriate to that locality. If the farmers need a cow-testing association, he will help them to organise it. If they need a breeding association, he will help them with it. The one big thing that he needs... is to have a good organisation of farmers behind him, supporting him in his work, and helping him to shape up the work itself”. The agent also introduces new and better varieties of seed, as well as improved cultural methods, etc.

Extension work with the women on the farms in the south was begun in 1910. In 1915 there were 350 women county agents at work in the southern states. They deal with the problems of the farm and farm economy. They teach home-gardening, the canning of fruits and vegetables from the gardens; they give demonstrations of labour-saving devices in the home — home-made affairs — leading to better conditions and greater economy in the home itself. “Women county agents are to-day reaching approximately thirty-five thousand homes in the south”.

A new value attached to the work and opportunities of the county agents as soon as the United States became involved in the war. In the agents both the Department of Agriculture and the agricultural colleges had a ready medium through which farmers and food-growers could be directly reached and immediately interested in the new movement. Local committees secured land in or near the cities for free allotments; and through the work of these committees, lawns were broken up for vegetable gardens. County agents, and supervisors working under them gave instruction on the spot to the amateur gardeners, and in many places they also helped them in securing seed and fertilisers.

In the fiscal year 1916-17 approximately \$34 000 000 were being expended by the Government of the United States on the Department of Agriculture, on the agricultural colleges and experiment stations, and on extension work under the Smith-Lever Act.

Appropriation to the department of agriculture . . . . .	\$25 000 000
MORRILL and NELSON funds for colleges of agriculture. . . . .	2 400 000
HATCH and ADAMS funds for experiment stations . . . . .	1 440 000
SMITH-LEVER Act. . . . .	1 580 000
MEAT inspection . . . . .	3 000 000
Printing funds . . . . .	600 000
Total . . .	\$34 020 000

The Department of Agriculture serves the urban communities in at least two ways. The inspection of all food products that enter into interstate commerce — all food products that are marketed outside the states in which they are grown and prepared for sale — comes under the Department. Many such products cannot be sold unless they bear the stamp of the Department. The urban population also shares, or can share, with the rural population in that part of the extension work which is devoted to home economics; and largely through the activities of the Federation of Women's Clubs, home economics are now being systematically studied by women in the cities. But in normal times no part of the propaganda of the Department is directed to persuading people to leave the cities in order to engage in farming. The object of the Department and of the agricultural colleges and the extension work is the same — to improve all departments of farm economy, to improve conditions on the farms and in the farm homes, and thereby to retain in rural pursuits the men, women and children who are now on the six million farms of the United States.

The writer gives the following bibliographical list:

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- III. *A Brief Statutory History of the United States Department of Agriculture*, by F. G. CAFFEY. Case and Comment, Vol. XXII, Nos 9-10, Feb.-March, 1916.
- IV. *Programme of Work of the United States Department of Agriculture for the Fiscal Year 1916-1917*. Prepared under the Direction of the Secretary of Agriculture by E. H. BRADLEY, July 1, 1916. Washington, Govt. Printing Office, 1916.
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## CROPS AND CULTIVATION.

- 128 - *The Relation of Movement of Water in a Soil to its Hygroscopicity and Initial Moisture* (1). — ALWAY, F. J. (Chief of Division of Soils) and MC DOLE, G. R. (Assistant in Soils, Agricultural Experiment Station of the University of Minnesota), in the *Journal of Agricultural Research*, Vol. X, No. 8, pp. 391-428, XX tables, 2 fig. + bibliography of 17 publications. Washington, August 20, 1917.

A short, historical review of the subject is given. Much work (TROMMER, VON LIEBENBERG, VON KLENZE, EDLER, WOLLNY, KRAKOW, GREBE, RAMANN, BRIGGS and LAPHAM, etc.) has been done on the upward movement,

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

(1) See B. 1914, No. 308; R. 1916, No. 8; R. 1917, No. 1114. (Ed.)

or capillary rise, of water, and the relation between its rate and distance and the texture of the soil; the results have shown that the finer the texture, the slower is the rise at first, but the greater the final distance reached. On the other hand, up to the present, the downward movement, or infiltration of the water, and the relation of its rate and distance to the texture of the soil, has been studied by a few workers only (VON LIEBENBERG ATTERBERG, WOLLNY, etc.). The results obtained are too discordant to justify definite conclusions, and usually refer only to coarse soils of low hygroscopicity; the relative hygroscopicity of the soils was never taken into consideration. Under natural conditions, in the moist region, the moisture content of the surface foot of soil is rarely as low as the hygroscopic coefficient ( $x$ ) and, in semi-arid regions, it rarely falls below this value.

The experimental conditions, then, were not in accordance with those found in nature. For this reason the authors undertook new experiments on the upward and downward movement of water, taking into account the hygroscopicity of the soils as expressed by their hygroscopic coefficients and their initial moisture. Seventeen soils, chosen for their different compositions, ranging from coarse sand (hygroscopic coefficient = 0.6), to a silt loam (hygroscopic coefficient = 13.3), were placed in three different degrees of moisture, corresponding to 0.5, 1.0 and 1.5 times the hygroscopic coefficient. The first condition corresponds to the lower limit of moisture in exposed surface soils after a prolonged drought during hot weather, the second to the condition found just after the ripening of a very heavy crop during warm, dry weather, the third corresponds to the wilting coefficient (BRIGGS and SCHANTZ) (1).

I. DOWNWARD MOVEMENT IN SOILS OF DIFFERENT INITIAL WATER CONTENT. — *Method*: — To bring the soils to the desired moisture content, air-dried material was shovelled over on oilcloth, the calculated amount of water being added meantime. The whole was then passed through a swing sieve, again shovelled, then placed immediately in a large, covered can, where it was left for several days. It was then again passed through the sieve, and returned to the can till needed for the experiment, when it was put into glass cylinders 36.2 cm. high and 7.8 cm. in internal diameter. In filling the cylinders, the soil was well pressed down while it was being put in. One inch of water was then added to the surface. To make the initial penetration more uniform, the cylinders were inverted in flat-bottomed trays, the desired amount of water added and allowed to rise into the soil by capillarity, until all, or nearly all, had been absorbed. The cylinders were then placed right side up, covered to prevent evaporation and protected from the sunlight.

The rate of penetration was observed during 5 days, the depth of the water being marked in pencil on the cylinders at intervals of 1, 3 and 24 hours. (More than one cylinder was used for each soil as a means of control, but, as the results coincided so well, only the averages are given). At the end

(1) For this term, see B. 1912, No. 903. (Ed.)

of the period of observation, the soil was removed from the cylinders, the moist part divided equally into three, and the moisture determined.

The results led the authors to the following conclusions, shown in the many tables given.

1) *Relation of the apparent specific gravity and the hygroscopicity.* — Fine-textured soils show a lower apparent specific gravity than the coarser ones, but no direct relation was found between groups of similar texture.

2) *Relation of water retentiveness to maximum water capacity.* — The value of the maximum water capacity is of little significance in the determination of water retentiveness. At the end of 1 hour, the moisture content is only from  $\frac{1}{2}$  to  $\frac{2}{3}$  of the maximum water capacity.

3) *Rapidity of change of moisture content in the moistened layer.* — The moisture content falls more rapidly with finer-textured soils; after 24 hours it is only 2 or 3 times the hygroscopic coefficient, while in coarser soils it varies from 5 to 10 times this coefficient.

4) *Relation of the rapidity with which equilibrium is attained to the hygroscopicity.* — The coarser the soil the more slowly is equilibrium reached; at the end of 5 days equilibrium had practically been attained in the finer-textured soils; this was far from the case in the coarser ones.

5) *Relation of hygroscopicity and the initial moisture on the one hand, and the rate and depth of penetration on the other.* — The rate of penetration depends little upon the hygroscopicity, but varies very much with the initial moisture, increasing in rapidity with an increased moisture content. The same applies to the depth of penetration, which is not closely related to the hygroscopicity, but depends greatly on the initial content; the depth of penetration increased with the moisture content during the 5 days.

6) *Relation of water content of the moistened layer to initial moisture.* — There is no distinct relationship for the finer-textured soils, but, with the coarser soils, the drier the soil, the wetter is the moistened layer.

It follows that, if rain is preceded by a period of high evaporation, the weather immediately following this rain will have a greater influence upon the loss of moisture by evaporation in the case of a coarse than of a fine-textured soil, as a result of the tardiness with which equilibrium is reached in the coarse soils.

II. UPWARD MOVEMENT IN SOILS OF DIFFERENT INITIAL MOISTURE CONTENT. — *Method:* — The same soils, in the same state of moisture (*i. e.* 0.5, 1.0, 1.5 times the hygroscopic coefficient), were used as in the previous experiment, and placed in tubes 160 cm. long and 3.0 cm in internal diameter. The soil was well packed, either by jarring the tube while the soil was added through a funnel, or else compressed with a rubber stopper on a wooden rod, passed through the metal funnel connected with the tube. The first method was used for soils the moisture content of which was 0.5 and 1.0 times the hygroscopic coefficient, the second for those 1.5 times the hygroscopic coefficient. The tubes were then placed upright in a rack, the lower end of each dipping into a metal trough and resting on a strip of 0.25 inch mesh wire netting, the object of which was to prevent both the entrance of water and the escape of air. Throughout

the experiment the water in the trough was kept at a depth of 1.5 inches. The experiments with soils of a content equal to 0.5 and 1.0 times the hygroscopic coefficient lasted 10 days, those for the other soils, 8 days. The height of rise was observed at the end of 1, 2, 3, and 24 hours during the first days, and then at the end of each 24 hours. At the end of the period the moisture in the uppermost layer of the moistened portion of the soil column was determined.

The results obtained led to the following conclusions: —

1) *Influence of the method of compressing the soil on the capillary rise.* — The jarring and compression methods have no influence on the soils in the driest condition; in the moist soils the compression method seems to retard the rise, at least during the first 24 hours.

2) *Relation of hygroscopicity to the rate and height of the rise.* — There is no definite relation; if, at the beginning, the rise is more rapid in soils of low hygroscopicity, this difference gradually disappears.

3) *Relation of initial moisture content to the rate and height of the rise.* — No definite relation was seen; in the three moisture conditions studied the rise was generally most rapid in the moistest and slowest in the intermediate.

4) *Distribution of moisture in the soil columns.* — All the finer-textured soils show the highest percentage of moisture at the top of the wet layer when used in the driest condition, but the coarser soils show no regularity. In soils other than sands, the moisture content of the wet layer is in close relation to the moisture retentiveness. From this it may be concluded that the wet layer has a moisture content equal to the moisture coefficient, *i. e.* from 1.7 to 2.5 times the hygroscopic coefficient.

III. — *RELATION OF PENETRATION TO CAPILLARY RISE.* — If the soils be arranged in order of the rate and depth of penetration and of the capillary rise, the relative positions of the various soils show no similarity. In other words, the relative rates and differences of penetration in the different soils are not similar to the relative rates and heights of capillary rise (this lack of similarity was shown by VON LIEBENBERG in his studies on dry soils).

Some of the soils used contained 3 and 4 times as much organic matter as the others. No characteristic relation was observed between the variation in organic matter and the rate and height of penetration; but the organic matter increased the capillary rise after the first day and the height attained in all the three moisture conditions studied.

129 — *Further Studies on the Nitric Nitrogen Content of the Country Rock.* — STEWART, R. and PETERSON, W., in *Utah Agricultural College Experiment Station, Bulletin No. 150*, pp. 20, 1 fig., VII tables. Logan, Utah, May, 1917.

Certain soils in western America contain spots very rich in nitric nitrogen, having often a nitric nitrogen content several hundred times higher than that of normal cultivated, irrigated soil. These are locally known as "nitre spots". Two theories have been expressed with regard to the origin of these accumulations: — 1) that of HILGARD, who attributed it to the more rapid nitrification of the organic matter of the soil in arid climates;

2) that of HEADDEN and SACKETT, who attributed it to the fixation of the atmospheric nitrogen by non-symbiotic bacteria.

Experiments made during 10 years by the authors on the influence of irrigation water on the production and movement of nitrates in irrigated soils, led them to form an entirely different opinion as to the origin of these nitre spots. They consider them to result from the leaching of the nitrates out of the pre-existing deposits in the rock and their local concentration by seepage water.

Two facts contributed to the formation of this opinion: — 1) it was found that nitrification is not appreciably more rapid in arid soil than in humid soil when measured by the nitrates present in the soil at various depths, in definite seasons and from year to year; 2) all the data supplied by HILGARD and HEADDEN on nitre spots, always mention additional amounts of other alkali salts.

Previous work had already shown that rock adjacent to the affected areas which had contributed to the soil formation, was impregnated with alkali salts, including nitrates, and in sufficient abundance to account for the accumulations noted. The investigations were continued with respect to various soils belonging to three geological formations — jurassic, cretaceous and tertiary. All cretaceous soils were found to contain nitrate. Tertiary soils contain slightly less, although it is in them that are found the greatest number of nitre spots. Jurassic formations have a much lower nitrate content (See Table I).

Analyses were made of soils from different parts of Utah, belonging not only to the cretaceous, tertiary and jurassic systems, but also to the triassic, permian and pennsylvanian. This proves that the formation of nitre spots is not limited to the rocks of any given geological system. The analytical method used was as follows: — 100 gm. of finely-ground rock were placed in a large flask with 1000 cc. of distilled water and shaken in the shaking machine for 16 hours. The solution was then filtered through a CHAMBERLAIN-PASTEUR filter, and the nitric nitrogen determined by the aluminium reduction method (1).

Table II gives the results found for the different districts, characterised, consequently, by a high total content of soluble salts. With two exceptions, however, the nitrate content is not 1 % of the total content.

The nitrate is carried from the original rock by seepage water, and more rapidly where the water escapes from leaking irrigation canals which cut the shale strata at some high point, thus allowing the seepage water to follow the shale strata to the point of outcrop, where the evaporation of the water produces a nitre spot. In cultivated soils the accumulation of nitrates is only found where the conditions allow the free movement of seepage water. Nitre spots may reach such a degree of concentration as to make growth impossible, both in cultivated and in virgin soil. Their characteristics are: 1) a high nitrate content; 2) the presence of large quantities of other soluble salts (chlorides and sulphates); 3) brownish colour; 4) thin

(1) See *B*, 1914, No. 206. (Ed.)

crust over the surface ; 5) mealy or ash-like condition under the hard crust ; 6) beneath this material is the soil, made moist, ~~sticky~~ and glistening by the continual presence of calcium chloride, which is known to be very deliquescent.

In rocks, as in soils, the nitrates are not independent of other alkali salts, and no case is known where nitrates only have been found ; sulphates and chlorides especially occur in large quantities. The content of nitre spots in nitrate, as well as in other salts, is very variable.

The characteristic brown colour is not due to the nitrates, which are colourless, but to their solvent and decomposing action on the coloured organic compounds of the soil. The non-symbiotic bacteria are essential neither to the formation of the colour nor to that of the nitrates, their presence being purely incidental ; this is proved by the fact that nitrogen fixation by these bacteria is greater in dry-farm soils, where no nitre spots are found. Investigations have shown that the maximum fixation is 15.8 mg. of nitrogen (SACKETT) per 100 gm. of nitre spot soil, whereas, in dry-farm soil, this maximum is 51.8 mg. of nitrogen (GREAVES).

The authors reproduced nitre spots artificially in the laboratory : — 300 gm. of rich greenhouse soil were treated with an excess of sodium nitrate solution (10 %), and dried slowly in the sun. The dry soil had all the characteristics of the nitre spots, which it retained when treated with a saturated solution of mercuric chloride or a 5 % solution of carbolic acid, i.e. when the soil was sterilised, thus definitely eliminating the action of non-symbiotic bacteria.

TABLE I. — *Percentage of sodium nitrate in various soils.*

	Maximum	Minimum	Average
<i>Tertiary soils :</i>			
Sandstone . . . . .	0.284	None	0.074
Shale . . . . .	0.750	None	0.147
Clay . . . . .	0.940	None	0.053
Ash . . . . .	3.280	0.0002	0.236
Alkali . . . . .	0.232	None	0.021
<i>Cretaceous soils :</i>			
Sandstone . . . . .	0.293	0.005	0.055
Shale . . . . .	1.026	0.003	0.104
Clay . . . . .	0.115	0.002	0.039
Ash . . . . .	3.270	0.005	0.870
Alkali . . . . .	3.350	0.003	0.074
<i>Jurassic soils :</i>			
Sandstone . . . . .	0.039	None	0.008
Shale . . . . .	0.019	None	0.005
Ash . . . . .	0.202	0.149	0.175
Alkali . . . . .	0.017	0.017	0.017



TABLE II — *Soluble salts and nitric nitrogen in various soils.*

District	Total soluble salts per million	Nitric nitrogen	
		parts per million	per cent of total salts
North of St George, Utah . . . . .	29 989	81.4	0.71
West of " " . . . . .	48 962	156.0	4.22
East of " " . . . . .	54 256	74.31	0.79
Northern Arizona . . . . .	51 858	27.3	0.212
Vicinity of Mt Carmel, Utah . . . . .	17 734	67.7	1.07
Vicinity of Cedar City, " . . . . .	36 055	28.7	0.16

130 — **Absorption and Other Modifications of Certain Fertilising or Anti-cryptogamic Compounds in Various Natural and Artificial Soils.** — DE WILKOSZEWSKI, BOGUMIL, *Archives des Sciences physiques et naturelles*, Vol. XLIV, No. 9, pp. 165-189; No. 10, pp. 256-275, 2 figs., 6 tables, bibliography of 23 publications. Geneva, 1917.

The author studied the absorption and other modifications undergone by ferrous and ferric sulphate; manganese sulphate, copper sulphate, calcium cyanamide, during their passage through natural and artificial soils, and through the physical constituents of the latter. The soils used were: — Loamy soils containing 0.38 % and 0.9 % of lime respectively.

"Angers soil", derived from the disintegration of schists, free from lime.

Loam freed from lime by repeated washing with hydrochloric acid.

Artificial soils and their constituents — Fontainebleau quartz sand, pure kaolin, pure calcium carbonate, heath soil composed entirely of humus without lime.

The soils, placed in glass dropping funnels 40 cm. high and 2 cm. in diameter, were gradually watered with solutions of the substances studied, and estimations were made of the liquid from the infiltration from time to time so as to keep count of the modifications which took place during the passage of the solutions through the soils.

The principal results may be summarised thus: —

**FERROUS AND FERRIC SULPHATES.** — The iron of the latter is more easily absorbed by the soil than the iron of the former, which, moreover, is found in the soil in the ferric state. This proves that ferrous iron is retained by the soil only after it has been oxidised, by hydrolysis, to ferric hydrate; it is even possible that the free acid acts partly on the hydrate formed and gives an insoluble basic salt which cannot be removed from the soil. This hydrolysis is greatly favoured by the presence of the soil particles. Calcareous soils retain the iron. Clay soils absorb ferric sulphate to a large extent, but ferrous sulphate only slightly, because oxidation takes place with difficulty.

**MANGANESE SULPHATE.** — After the solution has filtered through the soil it contains manganese oxides, perhaps even manganese peroxide; the catalytic action of manganese used as fertiliser is probably due to this phenomenon.

**COPPER SULPHATE.** — In the experiments with this salt the Cu<sup>++</sup> ion was retained in the form of a hydrate, or perhaps in the form of an insoluble basic salt, for the SO<sub>4</sub> ion is found in the filtration liquid.

In a general way it may be concluded that it is not the salts themselves which are retained by the soils, for they are hydrolysed, their base is rendered insoluble and the acid ion passes into the drainage water.

**CALCIUM CYANAMIDE.** — This is now known to change in the soil to urea, ammonium carbonate, nitrites and nitrates. The author further proved that when calcium cyanamide solution filters through the soil the change into urea and ammonium carbonate is much more marked than when solid cyanamide is dug in.

According to the author these changes are not due to bacterial action but to the capacity of the soil to facilitate the fixation of water, thus causing hydrolysis. This is proved by the fact that the transformation occurs immediately, both in arable and *sterilised* soil. Oxidation is favoured by soils of a spongy structure, such as infusorial soil, which has an obvious catalysing action, and where the nitrification of the cyanamide, urea and ammonium carbonate reaches its maximum. The production of nitrites was about 20 times greater in these soils than in ordinary ones.

Special attention should be given to the nitrification of the cyanamide in the soil in the absence of all organisms. The conditions under which this change takes place are not clear, and the author proposes to study them. During his studies he observed that Nessler's reagent does not form a red precipitate with the ammonium ion in the presence of calcium cyanamide.

131 - **Relation of the Transformation and Distribution of Soil Nitrogen to the Nutrition of Citrus Plants.** — See No. 173 of this Review.

132 - **Vegetation on Swamps and Marshes as an Indicator of the Quality of Peat Soil for Cultivation.** — DUNNEWALD, T. J., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 322-324. Washington, October 22, 1917.

Most workers have concluded that the surface vegetation on peat gives no clue to the relative quality of the soil for the purposes of cultivation. On the other hand, farmers and drainage men often assert that peat on a black spruce (*Abies nigra*) or moss covered swamp is no good for cropping, whereas good black muck with elm or ash on it is the best kind of land to drain.

Under the drainage law of the State of Wisconsin, the author, a member of the staff of the Wisconsin Agricultural Experiment Station, examined an area of about 6 600 acres of scattered marshes and swamps. The upland is non-calcareous glacial drift, derived from granitic and sandstone rocks, with no limestone in the vicinity. The author wished to discover whether a favourable or unfavourable chemical condition would be found in different areas of the peat, and whether the vegetation would give any indication of such conditions.

A field study showed that spruce (*Abies nigra*) and tamarack (*Larix americana*) peat areas were the wettest, with the water table practically at the surface of the soil, and a covering of 12 to 18 inches of spongy moss. The depth of the peat or distance from the shore seemed to have little effect

on the kind of surface growth, and the degree of decomposition of the peat has hardly more effect.

Table I summarises the more important determinations made in the laboratory. All the samples, except No. 7, were taken from a depth of 6 to 20 feet. Samples 1 and 2 were taken from different parts of the same swamp. Fine sand grains were found in Nos. 7 and 10 and not included in the average loss on ignition. The data show that peat bearing black spruce and tamarack has 20 % less mineral matter, a much higher degree of acidity, and somewhat less nitrogen.

The greater acidity of spruce and tamarack peats may be due to the more continual flooded conditions of these swamps, and drainage experience shows that this acidity often disappears largely after the peat has been drained and cultivated. The author considers his experiments confirm the farmer's statement that trees, such as ash, elm, birch and white pine (*Pinus Strobus*) show a better quality peat than that on which grow only black spruce, tamarack, sphagnum moss, blueberries and cassandra (*Cassandra calyculata*).

Determinations of the solubility of the peats in 150 cc. of a 2 % caustic soda solution, showed acid peats to be from 3 to 8 % more soluble than the less acid ones, but, if an amount of the solvent sufficient to counteract the extra acidity of the spruce peats be used, the difference in solubility is not noticeable.

*Comparative determinations of the organic matter, acidity and nitrogen in peat soils in the same district bearing different classes of vegetation.*

Number of soil	Vegetation	Loss on ignition	True acidity	Total nitrogen
2	Tamarack ( <i>Larix americana</i> ) . . . . .	78.56 %	very strong	1.58 %
4	Tamarack ( <i>Larix americana</i> ) and moss.	79.11	strong	1.98
	<i>Average</i> . . .	<b>78.80 %</b>	strong	<b>1.78 %</b>
5	Black spruce ( <i>Abies nigra</i> ) and moss . .	85.48 %	very strong	1.86 %
8	Black spruce ( <i>Abies nigra</i> ) and moss . .	91.07	very strong	1.86
9	Black spruce ( <i>Abies nigra</i> ) and moss . .	90.89	very strong	1.90
11	Black spruce ( <i>Abies nigra</i> ) and moss . .	88.14	very strong	1.69
14	Black spruce ( <i>Abies nigra</i> ) and moss . .	93.01	very strong	1.82
	<i>Average</i> . . .	<b>88.90 %</b>	very strong	<b>1.81 %</b>
1	Mixed ash, birch and balsam ( <i>Abies balsamifera</i> ) . . . . .	60.61 %	very slight	1.96 %
3	Large ash ( <i>Fraxinus americana</i> ), birch, poplar and cedar . . . . .	81.01	slight	2.17
6	Birch, ash, elm . . . . .	66.91	medium	2.02
7	Mixed birch, ash, tamarack ( <i>Larix americana</i> ), willow . . . . .	56.85	slight	—
10	Ash, birch, a few large tamarack ( <i>Larix americana</i> ) and pine . . . . .	47.14	medium	—
17	Elm, ash, cedar and grass . . . . .	62.08	medium	2.20
	<i>Average</i> . . .	<b>67.60 %</b>	slight	<b>2.09 %</b>

133 - **Practical Information for Beginners in Irrigation.** — FORTIER, SAMUEL, in U. S. Department of Agriculture, *Farmers' Bulletin* No. 864, pp. 38, 23 figs, 2 tables. Washington, September, 1917.

The U. S. Department of Agriculture has just published a revised edition of the *Farmers' Bulletin* No. 263, originally published on July 31st., 1906. It contains practical information for farmers who wish to settle in the centre and west of the United States where irrigation is essential. Besides general considerations on arid soils and water supplies for irrigation, the bulletin contains practical advice on selecting a farm under an irrigation system, and more detailed descriptions of the location and construction of farm ditches, the preparation of the land to be irrigated, the irrigation of a few of the staple crops (alfalfa, grain, potatoes, fruit trees and small fruits and vegetables), and the amount of water to be used.

Canal companies supply water to farmers by contract. Up to a few years ago the prevailing type of contract was one providing for the sale of a perpetual water right for a given tract of land, with an additional annual charge for the operation and maintenance of the canal system. This type is not usual now, the most common being the sale, with the land to be irrigated, of rights which carry an interest in the works supplying water, so that they become the property of the landowners when a fixed portion of the rights have been paid for. The cost of building the works is not included in the purchase price of the land, but is levied in the form of taxes.

The quantity of water to be supplied by the companies is fixed by contract. The most usual is a stream of given size, say 1 cubic foot per second for each 80 acres of land to be irrigated. Others agree to supply enough to cover the land to a given depth, say 2 feet, during each season.

Irrigation water may also be obtained from the Government at a stipulated price per acre. In this case the water is supplied to private landowners through a water users' association, in which all the landowners within the project become shareholders. The cost of a water right under a Government project varies from \$25 to \$29 per acre, and is payable in 20 annual instalments. When the payments for the water for the major portion of the land have been made, the operation and management of the irrigation system, exclusive of all storage reservoirs, passes to the owners of the land irrigated, to be maintained and operated at their expense.

After having discussed the construction of farm ditches, undertaken by the farmers themselves, the author gives the customary measurements of ditches, and, in a series of figures, gives the sections for specified ditches. The water is controlled by means of division boxes, made usually, and most economically, of wood. Stress is laid on the necessity of avoiding useless loss of water, either by faulty preparation of the soil, by carelessness, or lack of supervision in the distribution of the water. Experience shows that the great danger in irrigation, in all the arid districts of the United States, arises from the lack of efficient drainage of the soil. Where the natural drainage is insufficient, the salts from the sub-soil accumulate on the surface and soon make all cultivation impossible. It is, therefore, under such conditions, essential to have recourse to artificial drainage, which is almost as expensive to instal as a water supply.

134 - Irrigation of Semiarid Soils by means of Wind Engines, in U. S. A. — See No. 207 of this *Review*.

135 - Citrus Irrigation in California, U. S. A. — See No. 173 of this *Review*.

136 - The Value of Coconut Poonac as Manure. — BAMBER, M. K., in *Department of Agriculture, Ceylon, Leaflet No. 1*, p. 1, Ceylon, 1917.

MANURES  
AND MANURING

Owing to the difficulty of freight and consequent lower demand, the price of coconut poonac (native coprah cake) in Ceylon has fallen considerably, and the question of its use as a manure instead of a food has arisen. Analysis showed it to contain the following percentages of manurial elements: —

Nitrogen . . . . .	3.33 %
Phosphoric acid . . . . .	1.47
Potash . . . . .	1.29
Lime . . . . .	0.90
Soda (as salt) . . . . .	1.17

If coconut poonac is compared with other cakes now used as manure, it is seen that, for the same quantity of nitrogen: —

to 100 lbs. groundnut cake correspond 210 lbs. coconut poonac.	
» » » castor cake No. 1	150
» » » » No. 2	135
» » » rape cake	120

For this reason, in spite of its high food value, and considering that it is liable to become rancid on keeping unless very thoroughly dried, it is advisable, under present conditions, to use poonac as a manure in the country producing it.

137 - Saltpetre: Its Origin and Extraction in India. — HUTCHINSON, C. M. (Imperial Agricultural Bacteriologist), in *Agricultural Research Institute, Pusa, Bulletin No. 68*, 1916, pp. 24 + IV plates. Calcutta, 1917.

The author has made a new study of the saltpetre industry in India (1) and shows that, under favourable conditions, the prospects for an increased production of Indian saltpetre are very promising. The present sources are not fully worked on account of the primitive native methods and the low price of crude saltpetre. In view of the favourable soil and climatic conditions in Bihar, artificial nitre-beds would probably form a useful added source of saltpetre. The present methods do not allow all the nitrate present in the earth to be extracted.

It is, therefore, necessary to devise a new, practical method of extraction, and to see whether the efficiency of the method would depend upon a relaxation or revision of the restrictions imposed by the Salt Department. The present conditions of the saltpetre trade also demands examination to determine whether a greater demand would result from organised efforts to improve these conditions by eliminating the middleman and standardising the product itself.

(1) See B. 1912, No. 57; see also INT. INST. OF AGRIC., *World's production and consumption of chemical fertilisers*, 2nd. edition, 1914. — *World's production of fertilisers and of chemical substances for agricultural use.* (Ed.).

138 - **Inventory of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction During the Period from April 1 to June 30, 1914** (1).— U. S. Department of Agriculture, Bureau of Plant Industry, Inventory No 39, pp. 183 + X plates. Washington, 1917.

This inventory describes or lists 1019 recently imported plants, many of which were acquired *by exchange with official institutions or private experimenters*. Among the most important may be mentioned:—

**CEREALS.**— The two principal rice varieties of Tarragona, Spain (Nos. 37 696 and 37 697); a collection of South African wheats (Nos. 38 618 to 38 631), including the best Boer varieties adapted to the poor, unmanured lands of that district; 11 varieties of wheat (Nos. 38 343 to 38 353) have been developed by the wheat breeders of the Department of Agriculture of New South Wales and are considered worthy of trial in the south-west of the United States; a selected Danish 2-rowed barley ((No. 37 706) and a 6-rowed variety (No. 37 707), showing peculiar resistance to smut (*Ustilago Hordei* and *U. nuda*) and leaf-spot (*Septoria graminum*), and a good quality, yellow spring oat (No. 37 708), selected by the Royal Danish Agricultural Society of Copenhagen; the dwarf Black Grushevsk sorghum (No. 37 733) from the farm of the Grand Duke Nicholas in the Ekaterinoslav Province of Russia, which is distinguished by early maturity, even in very cold summers, and is the best yielder of 20 varieties tested there; a variety of maize (No. 38 544) grown by the Panetes Indians of the Upper Gy Parana (Machabo) River of Brazil.

**FORAGE CROPS.**— The most remarkable is *Merremia hederacea* (No. 38 647), a creeping plant of the convolvulus family from the Island of Guam; stock prefer it to any of the other forage plants of the island and it may be grazed all the year round; 59 wild or cultivated forage grasses from Brazil (Nos. 37 983 to 38 041); the Apitrefle, or bee clover (No. 37 937) from Prof. G. MARTINET of Lausanne, Switzerland, a variety of red clover with shortened, more open flowers, which enable the bees to collect the honey with greater ease; 2 annual species of clover from Budapest, *Trifolium angulatum* and *T. parviflorum* (Nos. 37 681 and 37 682), which remain dwarf in dry years, serving as pasturage, but grow high enough for hay in wet spots or in wet years; a wild type of Kentish white clover (*Trifolium repens*) (No. 38 579), which experiments at Armstrong College, Cockle Park, England, have shown to be superior to Dutch clover (2); many hardy varieties of sugar cane (Nos. 38 257 and 38 332), from Chengchow and Kaifeng, in Henan Province, which might be grown above the natural cane belt in the South of the United States and be useful for fodder, if not for syrup production; a very early-ripening Italian rye-grass (*Lolium multiflorum*) (No. 37 709), a meadow fescue (*Festuca elatior*) (No. 37 710), very resistant to rust (*Puccinia*) and an orchard-grass (*Dactylis glomerata* sub-variety "Olsgaard") (No. 37 711) all selected by the Royal Agricultural Society of Denmark; the Jua tree (*Ziziphus joazeiro*) (No. 37 923) from Joazeiro, Brazil, the fruit and leaves of which are used as food for stock.

(1) See R. Dec. 1917, No. 1129 (Ed.) — (2) See R. Sept. 1917, No. 814. (Ed.)

**FIBRE PLANTS.** — Caroa (*Neoglaziovia variegata*) from Joazeiro (No. 37 705), a wild Bromeliaceae growing on the São Francisco River, used by the native for ropes; the piassava palm (*Attalea funifera*) from Bahia (No. 37 868), from the fibre of which excellent brooms and brushes are made, while buttons are manufactured from the hard nuts.

**OIL-YIELDING PLANTS.** — Ngart (*Plukenetia conophora*) (No. 38 644), a creeping Euphorbiaceae, cultivated throughout the Ossidinge district (Cameroons). The thin-shelled nut contains a hard oily kernel. Experiments have shown that neither the kernel nor the oil contain harmful substances. The kernels, without the shells, weigh 4 or 5 grams and give 53.8 % of a drying oil, resembling linseed oil, and used by the natives. The fatty residue contains 45.6 % of protein.

The characteristics of ngart oil are: —

Specific weight at 17.5°C	—0.934
Congeaing point	— 33°C
Iodine number of the oil	177.3
Iodine number of the free fatty acids	187.4
Saponification number	192
Refractive index at 17.5° C.	—1.4830

(KRAUSE and DIESSELHORST, *Tropenpflanzer*, Vol. XIII, p. 282, 1909).

From the leaves of the carnauba wax palm (*Copernicia cerifera*) (No. 37 866), imported from Joazeiro, is obtained a wax that was formerly used for phonograph records. Its fruit is an excellent food for pigs, and it should not be impossible to plant groves of these palms for hog pasturage.

**GUM PLANTS.** — The true gum-arabic acacia (*Acacia vereh*) (No. 38 524), from Khartoum, may be capable of acclimatisation in the south-western desert district of the United States.

**DRINK-YIELDING PLANTS.** — Chici (*Salvia* sp.) (No. 38 048), from Zacuapam, Huatusco, Vera Cruz, Mexico; the seeds are put in water, where they swell and soften, mixed with sugar and red wine, and used as a drink; Ava or Kava (*Piper methysticum*) (No. 38 291), from Pago Pago, American Samoa, used as a drink.

**VEGETABLES.** — Many interesting species have been imported. A new variety of roselle (*Hibiscus sabdariffa*) (No. 37 698), called "Temprano", created at the Lamo Experiment Station, Philippine Islands, is a sport from the "Victor" variety, ripening 20 days earlier; it may be grown for jelly further north than the Victor can be grown; a cucumber (No. 37 700) introduced into the Philippines from Seharunpur, India, has shown resistance to insect attack and is proving one of the best varieties for cultivation in the tropics; a hybrid between thousand headed kale and kolh-rabi, obtained by E. WEBB and SONS, Wordsley, England; it has a thickened stem growing 5 feet high, which is suitable for forage during the winter; a Chinese ginger (*Zinziber officinale*) (No. 38 180) from Feichang, Shantung, the candied rhizomes of which are shipped in large quantities to the United States; 5 varieties (Nos. 38 356 to 38 360) of the very best starch, table and feeding potatoes of Polish origin, produced by M. HENRY DOROWSKI; the New Era potato, (No. 37 947), said not to be affected by potato blight (*Phytoph-*

*thora infestans*), has been obtained from New Zealand; a variety of the yam-pee yam (*Dioscorea alata*) (No. 37 943), produced at Avon Park, Fla., deserves serious study as it does well in very light sandy and rocky soil where potatoes will not grow; from Coban, Guatemala, have been imported seeds of the pacaya salad palm (*Chamaedorea* sp.) (Nos. 38 403 and 38 404) which, after 3 or 4 years, produces from 4 to 6 fleshy inflorescences about the size of ears of maize which, when cooked, make a delicate salad; it is believed that this species will grow in southern Florida.

FRUIT TREES. — Galo (*Anacolosia luzoniensis*) (No. 38 395), from the mountains of Cavite (Philippines) with a kernel having the flavour of maize; K'uei li tzu (No. 37 799) a superior large-fruited form of the blight-resistant Chinese chestnut (*Castanea mollissima*), introduced from Sianfu, Shansi; 24 new varieties of oriental persimmon (*Diospyros Kaki*), 11 of which come from Tongjapu (Nos. 37 648 to 37 658), including an especially valuable variety for drying purposes; an improved variety of *Diospyros lotus* (No. 37 811) used for stocks in the loess table-lands, which are very dry and alkaline; 5 new forms of persimmon from Shansi province (Nos. 37 661 to 37 665); the salt-bag persimmon and honey-pot persimmon (Nos. 37 672 and 37 678), the latter a prolific and showy bearer of fruit no larger than a cherry; both were imported from Shansi; 5 varieties from Shantung (Nos. 37 948 to 37 952), one of which is eaten pickled in brine; a staminate variety (No. 38 482), found in Bermuda, valuable as a polleniser. The importance of finding a pear resistant to blight (*Bacillus amylovorus*) induced MR. MEYER to continue his search for a better flavoured melting Chinese pear; from Shansi, Honan and Shantung he sent 15 varieties of more or less promise for breeding purposes (Nos. 38 240, to 38 242, 38 262 to 38 271, 38 277 and 38 278; the Rev. HUGH W. WHITE sent from Yencheng, Kiangsu, the Tangshan pear (No. 37 982), the only sweet, juicy pear with a woody taste he has seen; an apricot variety (No. 37 744) from the Dakhleh Oasis of Egypt, capable of resisting an annual temperature of 75° and monthly averages of 90° F.; from Shansi were received 14 varieties of Chinese jujube (*Ziziphus Jujuba*) (Nos. 38 243 to 38 247, 38 249 to 38 253 and 38 258 to 38 261), some with fruit as large, or larger, than hens' eggs, being more like small pears; they may be eaten fresh, cooked in various ways or preserved with honey, sugar, etc.; a variety of Chinese haw (*Crataegus pinnatifida*) (No. 38 176), the red-fleshed, large fruit of which will keep several months; the Fei peach (No. 38 178), considered the best in China on account of its size, lateness (middle of October), good shipping qualities and aromatic flavour; from Rio de Janeiro and Bahia, Brazil, came scions from 24 navel oranges, selected on account of their high yield, uniformity of fruit, sweetness, vigour, absence of spines and tendency to bear throughout the year; the Selecta orange (Nos. 37 796 and 37 840 to 37 842); the pear orange (Nos. 37 797 and 37 843); the bitter orange, laranja da terra (No. 37 775); the seedy sweet orange, laranja da china (No. 37 776); the last two are used as stocks for the navel orange; the lime orange (No. 37 784), with a flavour intermediate to that of the orange and the lime; a much esteemed orange-



ade is made from it (a typical fruit weighs 350 grams and gives 125 cc. of juice).

A Nakon Chaisri seedless Siamese pummelo (No. 37 724) from Bangkok; the alamoen from Surinam (No. 37 804), a superior variety of grapefruit; the desert kumquat (*Eremocitrus glauca*) (No. 37 712) and *Atalantia monophylla* (No. 38 511), from India and Ceylon; from Cavite province, *Euphoria cinerea* (No. 38 374), a remarkably sweet Sapindaceae; from Coban, 4 varieties (Nos. 38 478 to 38 481) of injerto (*Acradelpha viridis*); from Guatemala, the pitaya (*Cereus triangularis*) (No. 38 601), a pleasant flavoured, deep-purple fruit produced by an epiphytic *Cereus*; from Cuba, rare species of *Anacardium excelsium* (No. 38 209); from Rio de Janeiro the "fruta de condessa" (*Rollinia deliciosa*) (No. 38171); the guabiroba (*Campomanesia feniziana*) (No. 37 834), whose fruit is highly esteemed for jellies; "cambuhy da India" (*Eugenia campestris*) (No. 37 830), "cereja do Rio Grande" (*E. edulis*) (No. 37 831), *E. speciosa* (No. 37 832); *Rheedia brasiliensis* (No. 37 802) from Rio de Janeiro; from Januaria, the imbu (*Spondias tuberosa*) (Nos. 37 861 to 37 865), one of the most popular fruits of the interior of Brazil. To the collection of subtropical fruit have been added 24 choice varieties of hard-shelled avocados (*Persea americana*) (Nos. 38 477, 38 549 to 38 564, 38 578, 38 581, 38 583, 38 587 and 38 638 to 38 640) from the district of Coban, Antigua and the city of Guatemala, some at an altitude of 5000 feet; their fruit ripens late (winter and spring) and is of good quality.

139 - The Effect of Different Rotation Systems and of Fertilizers on the Protein Content of Oats. — THATCHER, R. W. and ARNY, A. C., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, p. 344-348. Washington, D. C., October 22, 1917.

The experiments described were carried out at the Minnesota Agricultural Experiment Station.

Work on the influence of various fertilisers on the composition of oat grains has already been published (1), but it has rarely been carried out over more than one season, and the results are often inconclusive.

(1) WOODS, C. D. (Effects of Different Fertilizers upon the Composition of Oats and Straw, *Connecticut Storrs Agricultural Experiment Station Report* for 1892, pp. 47-56), found an apparent increase in protein content of both straw and grain in proportion to the quantity of nitrogen applied in the fertiliser.

WEISULL, M. (Cooperative Fertilizer Experiments in Malmöhus County, Sweden, 1902; Abstract in the *Experiment Station Record*, Vol. XV, p. 570, 1903), using the composition of the crop as an index for the fertiliser requirement of the soil, concluded that, since there was a slightly increased percentage of nitrogen in the grain and of potash in the straw from plots fertilised with these elements, and no consistent increase of phosphoric acid in grain from plots treated with phosphate fertilisers, the soils were in need of nitrogen and potassium, but not of phosphorus.

PINGREE, M. H. (The Influence of Nitrogenous, Phosphatic and Potassic Fertilisers upon the Percentage of Nitrogen and Mineral Constituents of the Oat Plant, *Pennsylvania Agricultural Experiment Station Report*, 1906, pp. 43-53), as a result of studies on oats in 1904, found that when nitrogen was applied alone there was a larger proportion of protein in the dry matter of the whole plant than when any other fertiliser was used. The proportion of protein was distinctly less on the unfertilised plot, still lower when potassium alone was used, and lowest of all when phosphoric acid was applied, even in a complete fertiliser.

In the studies described the samples analysed were taken from soil in which there was regular rotation, and, consequently, from different plots each season. The possibility of the effects being due to soil differences or to accumulations from previous soil treatments was thus reduced to a minimum. The same variety of oats was used in all the experiments; the rate and date of sowing, method of harvesting, etc., were identical each year. The methods of rotation and fertilisation were as follows:

**ROTATION PLOTS.** — *Continuous Oats.* — This plot was sown with oats each spring from 1909 onwards. Manure was applied at the rate of 6 tons per acre in the autumn of every third year; the last application was in 1915.

*Two-year rotation; oats and wheat or oats and maize.* — The method was the same as for continuous oats.

*Three-year rotation; no manure, maize, oats and clover. Model rotation.* — The same treatment as in the previous case, except that, for Model rotation, manure was applied the autumn before the planting of maize at the rate of 6 tons per acre.

*Four year rotation: maize, oats, wheat, clover.* — In the autumn preceding the maize, 8 tons per acre of manure were applied.

*Five-year rotation: maize, oats, wheat, clover, timothy hay.* — In the autumn preceding the maize, 10 tons per acre of manure were applied.

**FERTILISER PLOTS.** — On all these plots there was a three-year rotation of maize, oats and clover. The fertilisers were applied annually, each one separately. The phosphates and potash were applied at sowing time, the nitrate after the grain and maize were up. The kinds and quantities used were as follows:

*Commercial fertiliser only.* — When the seed bed was prepared 250 lbs. of acid phosphate and 100 lbs. of muriate of potash per acre were applied, half to the oats and half to the

TRETIKOW, S. S. F. (Influence of Mode of Cultivation on the Chemical Composition of Cereals; Abstract in *Experiment Station Record*, Vol. XXXIV, p. 230, 1916), found that barnyard manure increased the protein content of oats from 11.38 to 12.81 %.

LIPMAN, J. G. (The Associative Growth of Legumes and Non-legumes, *New Jersey Agricultural Experiment Station, Bulletin* 253, 1912), studied the effect of potassium sulphate and of sodium nitrate on oats grown alone and with peas, in large galvanised iron cylinders in the field and in pots in the greenhouse, and on other legume and non-legume combinations. He concluded that:

1) Under favourable conditions non-legumes associated with legumes may secure large amounts of nitrogen from them, even though this may not be shown by an increased proportion of nitrogen in the dry matter of the non-legume; 2) when sodium nitrate is applied to such crop mixtures, the non-legumes gain an advantage in the competition for moisture, light and plant-food, and the growth of the legume suffers. The legume contains not only less dry matter and nitrogen, but may also contain a smaller proportion of nitrogen in the dry matter.

LYON, T. L. and BIZZELL, J. A. (A Heretofore Annotated Benefit from the Growth of Legumes, *New York (Cornell) Agricultural Experiment Station, Bulletin* 294, 1911), noted an increased protein content in timothy when grown with alfalfa or clover, and of oats when grown with peas, as compared with that of the grass or cereal when grown alone on adjacent plots in the same season.

None of these studies deal with the effect of a legume in the rotation upon the protein content of the crops grown in the intervening years, and the work described in the paper under review seems to be the first on this subject.

maize. After the grain was up 300 lbs. per acre of nitrate of soda were applied, half to each crop

*Manure and commercial fertiliser.* — Manure at the rate of 6 tons per acre; commercial fertiliser as in the previous case.

*Manure and nitrate of soda.* — Each year 6 tons of manure per acre were applied to the maize, and, in addition, 320 lbs. per acre of nitrate of soda, half to the oats and half to the maize.

*Manure and muriate of potash.* — Each year 6 tons per acre of manure were applied to the maize, and, in addition, 200 lbs. of muriate of potash per acre, half to the oats and half to the maize.

*Manure and raw rock phosphate.* — Each year 6 tons of manure and 1 000 lbs. of raw rock phosphate per acre were applied to the maize.

*Manure and acid phosphate.* — Six tons of manure per acre were given to the maize, and, in addition, 400 lbs. of acid phosphate per acre, half to the oats and half to the maize.

Tables I and II, which give the results of the analyses of the oats from the various plots, show a definite effect of the rotation system on the chemical composition of the crop. Short rotations without clover or an intertilled crop requiring summer cultivation of the land, always gave oats with a low protein percentage. The three-year rotation with clover, with or without manure, and with at least one maize crop to provide summer cultivation, gave, without exception, oats of medium protein content. Longer rotations, with clover, or with clover and pasture; yielded oats of high protein content.

TABLE I. — *Effect of different rotation systems upon the protein content of oats, expressed as percentage of protein in the dry matter.*

Rotation	Manure per acre	Percentage of protein in dry matter			
		1914	1915	1916	Average
Continuous oats. . . . .	6 tons each 3rd. year. .	12.94	11.96	13.02	12.64
2 year, oats and wheat. .	do. . . . .	12.63	12.17	12.73	12.51
2 year, oats and maize. .	do. . . . .	13.25	11.95	13.13	12.78
3 year, oats, clover, maize	None (control)	14.00	14.66	15.46	14.71
3 year, oats, clover, maize	6 tons preceding maize .	14.63	13.45	14.92	14.33
4 year, wheat, clover, maize, oats . . . . .	8 tons " " . .	15.25	15.73	14.89	15.29
3 year, wheat, clover, pasture, maize, oats . .	10 tons " " . .	15.88	14.49	15.05	15.14

Table II shows a definite correlation between the protein content of the oat grain and the fertiliser treatment. Plots receiving nitrogenous fertilisers invariably produced grain with a higher protein content than plots receiving any other treatment. The single sample having the highest percentage of protein and the highest average for the four-year period was obtained with the use of nitrate of soda. The complete fertiliser contained enough readily available nitrogen to produce nearly the same effect upon the composition of the oats as the sodium nitrate alone. The potash fertiliser

produced oats with a slightly lower protein content than those from the control plots in every one of the four years. The phosphate fertilisers did not materially change the protein content of the grain, which was sometimes a little higher, sometimes a little lower, than that from the control plots. The average protein content was practically identical in the control, raw rock phosphate and acid phosphate plots.

TABLE II. — *Effect of different fertilisers upon the protein content of oats grown in a 3 year rotation of oats, clover, maize, expressed as percentages of protein in the dry matter.*

Fertiliser	Percentage of protein in dry matter				
	1913	1914	1915	1916	Average
None (control) . . . . .	14.56	14.63	13.09	14.92	14.30
Commercial only . . . . .	16.00	15.31	13.57	16.10	15.24
Manure + commercial . . . . .	—	14.69	15.00	15.57	15.09
Manure + nitrate of soda . . . . .	15.13	15.88	16.14	15.80	15.74
Manure + muriate of potash . . . . .	13.81	14.69	12.06	14.06	13.40
Manure + raw rock phosphate . . . . .	14.12	13.69	14.06	14.46	14.16
Manure + acid phosphate . . . . .	14.31	13.94	15.10	14.40	14.44

140 — **The Composition of Grain Sorghum Kernels.** — Le CLERC, J. A. and BAILEY, L. H., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 1, pp. 1-16, bibliography of 7 publications. Washington, D. C., January, 1917.

This paper gives the average results of a large number of analyses of the seed of grain sorghums made at the Office of Cereal Investigations of the Bureau of Plant Industry, U. S. Department of Agriculture, during the 5 years 1908 to 1912, from crops grown at the Panhandle of Texas. The varieties analysed were durra, durra kafir, kafir, kaoliang, milo, broom-corn, shallu. From the data obtained interesting conclusions were drawn regarding: — 1) the correlation between the various chemical and morphological characters; 2) the influence of rain on the quantity and quality of the product.

A) CORRELATION OF CHARACTERS. — 1) Unlike wheat, there is no well-defined relation between the weight of 1000 grains of sorghum and the protein content (see Table I). In the milos alone there appears to be a slight tendency towards a positive correlation, *i. e.*, the heaviest grains are those richest in protein. In the other varieties the correlation is inclined to be negative.

2) Low protein content is usually accompanied with a high weight per bushel, and a low content in fibre, ash and pentosans.

3) There is often a correlation between large grains and a low fibre content; large grains have a relatively smaller superficial area than small grains, and consequently less bran, in which the greater part of the fibre is found. With this negative correlation with fibre goes also a negative correlation with ash.

4) There is a positive relation between the ash content and the protein and fibre content, but a negative relation between the ash content and the weight of 1000 grains and the weight per bushel.

B) INFLUENCE OF METEOROLOGICAL FACTORS. — The vegetative period, from April to ripening, was divided into three parts: — 1) April to emergence, 2) emergence to heading; 3) heading to ripening.

Table II summarises the averages of the data obtained. The rainfall of the second and third periods did not have any marked influence on the composition or yield; for example, milo, dwarf milo, brown kaoliang, black-hull kafir and red kafir had a high protein content in 1909 and a low protein content in 1908, although the rainfall during the second period was practically the same both years. The same results were obtained for the third period. Nevertheless there seems to be a certain relation between the harvest and the rainfall during the first period *i. e.* from April to emergence and also between the harvest and total rainfall.

The amount of protein per acre is higher when the rainfall is heavier. Thus, in 1908 and 1911, when there was a copious rainfall throughout the vegetative period and during the first period, the average protein yield per acre was from 181.4 to 245.4 lbs., whereas in 1909, 1910 and 1912, when the rainfall was less, the average protein yield varied between 66.8 and 110.3 lbs. per acre. The same relations observed for protein yield were also observed for grain yield.

TABLE I. — *Relation of protein content to the other constituents of sorghum.*

Variety	Protein N. $\times$ 6.25	Water	Ash	Fat	Fibre	Carbohy- drates	Weight of 1000 grains	Weight per bushel
	%	%	%	%	%	%	gram.	lbs
<i>Milo:</i>								
Protein less than 10.75 % . . . . .	10.69	9.36	1.59	3.27	1.43	73.69	34.9	58.2
Protein more than 13.70 % . . . . .	13.75	9.25	1.66	3.08	1.50	70.76	36.1	58.1
<i>Dwarf Milo:</i>								
Protein less than 9.62 % . . . . .	9.56	9.48	1.54	3.37	1.39	74.65	29.8	58.8
Protein more than 13.50 % . . . . .	13.56	9.57	1.67	3.23	1.53	70.48	32.1	57.7
<i>Brown Kaoliang:</i>								
Protein less than 11.50 % . . . . .	11.49	9.35	1.84	4.17	1.27	71.96	19.0	56.7
Protein more than 14.70 % . . . . .	14.75	9.88	1.95	4.07	1.50	67.94	17.7	55.2
<i>Blackhull Kafir:</i>								
Protein less than 12.60 % . . . . .	12.56	9.45	1.66	3.53	1.58	71.30	23.1	58.7
Protein more than 15.20 % . . . . .	15.25	9.60	1.85	3.44	1.57	68.22	20.8	58.1
<i>Red Kafir:</i>								
Protein less than 11.20 % . . . . .	11.13	9.92	1.60	3.12	1.44	72.80	21.5	58.6
Protein more than 13.70 % . . . . .	13.75	9.82	1.79	3.22	1.46	69.96	20.5	57.9
<i>Durra and Durra-Kafir:</i>								
Protein less than 12.46 % . . . . .	11.90	9.55	1.87	3.57	1.39	—	24.4	57.9
Protein more than 14.60 % . . . . .	15.08	9.08	1.95	3.58	1.63	—	23.7	55.5

TABLE II. — *Influence of rainfall on the protein yield and the grain yield (averages).*

Year	Protein %	Rainfall				Yield of grain per acre lbs.	Yield of protein per acre lbs.
		Total April to ripening. inches	April to emergence inches	Emergence to ripening inches	Heading to ripening inches		
1908 . .	12.05	16.24	5.42	8.27	3.81	2 041	245.4
1909 . .	13.55	12.77	1.65	8.84	2.80	493	66.8
1910 . .	13.57	10.04	3.44	5.49	2.74	680	91.1
1911 . .	11.71	16.44	8.30	4.68	2.52	1 568	181.1
1912 . .	13.96	10.68	2.17	6.06	2.84	795	110.3

141 — **The Action of the Constituents of the Ash on the Life of Plants.** — EGOROV, M., in: I *Журналъ Опытной Агрономіи* (*Journal of Experimental Agriculture*), Vol. XVI, Pt. 4, pp. 270-280. Petrograd, 1915. — II. *Ibid.*, Vol. XVIII, Pt. 1, pp. 1-13 + 2 figs. 1917.

I. — The direct cause of the ripening of Gramineae, shown by the yellowing of the plant, is the migration of large quantities of magnesium to the seeds where it becomes fixed. In support of this hypothesis the author quotes the work of ARENDT and of WILLSTÄTTER (1), and describes his own experiments on oats, with and without castration, in which a chemical and morphological examination showed that, towards the period of ripening, castrated oats remain green. This is probably due to the fact that the magnesium does not leave the circle of the vital functions of the plant, so that there is no visible decrease in chlorophyll.

If later experiments confirm this hypothesis of the action of magnesium in the ripening of oats, it may be possible to solve the more important problem of why annual plants are only annual and not perennial.

II. — The action of the constituents of the ash on the life of plants is not sufficiently well known, and this second study is only an attempt to ascertain some specific properties of potassium. The experiment carried out by the author with young maize plants and a full-grown barley plant proves that, contrary to STOKLASA's thesis, the synthesis of the organic substance which takes place in the plant is not modified in ratio to the decrease of potassium oxide in the food. This modification is not sufficiently great to inhibit more or less the vegetative life of the plant (with regard to the amount of potash), but one function (perhaps even a series of functions) is essentially disturbed by a decrease of potash in the food; this function is the filling, or rather the emptying, of the grains of carbohydrates. In other words, the decrease of potash in the food results immediately in the transition of the carbohydrates from the organs in which their synthesis takes place to the parts where they accumulate temporarily. This fact accords with

(1) WILLSTÄTTER, Untersuchungen über Chlorophyll, 1913. — ARENDT, *Landwirtsch. Versuchs-Stationen.*, I, 1859. (Ed.)

the previous observations of M. ARENDT, according to which a small amount of potassium oxide remains in the grain, while the greater part, on the one hand, accumulates, after having fulfilled its functions, in other parts of the plant, and, on the other hand, passes into the soil or nutritive solution.

142 — **The Effect of Greenhouse Temperatures on the Growth of Cereals.** — HUTCHESON, T. B. and QUANTZ, K. E., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 1, pp. 17-21, 1 fig., 2 plates. Washington, D. C., January, 1917.

The results are given of studies on the effect of different temperatures on the growth of wheat, oats, barley and rye from the date of sowing, December 21, 1915, till May 27, 1916, when the experiment was discontinued owing to the extreme heat in the houses. Four temperatures were chosen and kept constant, so far as possible, throughout the experiment: 75°F., 65°F., 62°F. and 58°F. The appended Table shows that the temperature has a considerable influence on the periods of heading, flowering and ripening of the different varieties. The order of maturity was sometimes almost reversed; thus at 75°F. oats headed first, at 58°F. rye was the first to head and oats came last. The Table also gives the number of tillers and heads for each plant and the average length of the culms and heads.

*Data on the growth of wheat, oats, barley and rye in greenhouses kept at various temperatures.*

Temperature Fahrenheit	Dates				Number per plant		Average length, inches	
	Emergence	Heading	Flowering	Ripening	Tillers	Heads	Culms	Heads
<i>Wheat.</i>								
75°	Dec. 28	May 10 27	May 13-27	—	8.75	0.87	35.05	4.24
65°	<i>id.</i>	May 15	May 20	—	8.00	1.75	31.48	3.28
62°	<i>id.</i>	Apr. 26	Apr. 29	May 29	5.37	3.00	45.05	4.38
58°	Dec. 31	May 2	May 3	—	1.25	1.12	36.74	3.68
<i>Oats.</i>								
75°	Dec. 29	Apr. 17	Apr. 26	May 24-27	9.00	4.62	30.46	7.13
65°	<i>id.</i>	<i>id.</i>	<i>id.</i>	<i>id.</i>	5.62	3.50	32.12	8.75
62°	<i>id.</i>	Apr. 25	Apr. 29	May 27	3.37	2.00	34.54	8.00
58°	Dec. 31	May 1	May 5	—	1.50	1.29	30.46	7.70
<i>Barley.</i>								
75°	Dec. 29	—	—	—	48.25	—	—	—
65°	<i>id.</i>	May 25	May 26	—	23.87	—	—	—
62°	<i>id.</i>	May 16	May 17	—	8.00	1.12	21.29	2.00
58°	Dec. 31	May 2	May 5	—	1.75	1.75	23.42	2.38
<i>Rye.</i>								
75°	Dec. 28	Apr. 25-May 27	May 3-27	—	29.25	1.12	31.30	4.64
65°	<i>id.</i>	Apr. 29	May 1	—	5.00	1.62	40.65	4.25
62°	<i>id.</i>	Apr. 18	Apr. 25	May 27	5.37	3.00	45.05	4.38
58°	Dec. 31	Apr. 17	May 2	—	1.00	1.00	60.31	4.88

The most interesting results may be summarised as follows. —

1) A cool temperature produces earlier maturity, except in the case of oats; a high temperature stimulates a rank growth of tillers, thus wasting energy needed for the formation of the heads.

2) The cereal most susceptible to heat is barley, which produces a great number of tillers which do not head. Wheat and rye also suffer considerably, but less than barley. Oats suffer very little.

3) The grain yield is highest for the plants grown at cool temperatures, except in the case of oats, which shows no difference in this respect.

#### 143 — The Selection of Cereals in Sweden and the Increased Production thus Caused.

— NILSSON, N. HJALMAR (Lecture and report read before the Swedish Seed Society in 1917), *Sveriges Utsädesförenings Tidskrift*, Year XXVII, Pt. 4, pp. 172-203, 14 tables, 5 figs. Malmö, 1917.

Already before MENDEL's theory, taken up anew by DE VRIES, CORRENS, TSCHERMAK, had given a new impulse to the improvement of cultivated plants by selection and hybridisation, Prof. NILSSON EHLE, in his work on hybridisation at Svalöf, has admitted clearly the existence of hereditary units which are transmitted integrally and independently of each other, and from 1900 onwards, in his selection experiments by pure lines, he applied the methods and conceptions enunciated by JOHANNSEN.

It was from 1900 that the activity of the Experiment Station of Svalöf working on a modern scientific basis, and following a well-defined, practical aim, began to have a definite influence on the agricultural development of Sweden, with excellent effects, especially on the cultivation of cereals.

It is known that the productivity of a given plant varies from one locality to another, according to the special environmental conditions. Thus, a wheat giving a good yield in England may, on account of its slight resistance to cold, give very bad results in Sweden; such is the case of Square-head wheat. The selector, therefore, aims above all at uniting in one individual the characters *high intrinsic yield* and *resistance to the most unfavourable meteorological factor or phenomenon* in a given district. For this reason were established branch Stations, each with their own experimental fields, to complete and extend the activity of the main Station at Svalöf by forming centres of study in distinct districts differing from an agrogeological and meteorological point of view, such as Ultana, Lulea, Linköping (Westgöta), etc.

*Resistance to cold* is the most indispensable quality for every cereal in the south as well as in the north of Scandinavia. Moreover, certain districts in the east of Sweden have so little rain in spring that it is also necessary to introduce *drought resistant* varieties. Finally, in Svealand, the fertility of the soil causes such a rapid and rank growth of the culms that varieties *very resistant to lodging* are essential.

It has thus been possible to create, among the different varieties of cereals, various types, all of which are good producers and adapted to different and well-defined meteorological and agrogeological conditions. Thus Primus barley does well in cold, moist, heavy soils, whereas the varieties Gull and Hännchen prefer a dry climate and light soils; Guldregn oats,



which are the most widely cultivated, owe their popularity to their earliness and a capacity for adaptation almost equal to that of the native varieties, whereas Fyris oats are suited to clay soils, and the Klock variety, to peat or marsh soil rich in organic matter.

The author gives, in chronological order, the results obtained during the 25 years 1889-1915, in the selection of wheat (winter and spring), rye, barley and oats (white and black). Numerous tables (the most important of which are summarised here) give the details necessary to judge the work done; the yields in grain of the best varieties successively created and propagated by the Svalöf Station are all compared with the average yield of the native varieties, taken as 100.

WINTER WHEAT (1). — This must, above all, be resistant to low temperatures. This explains the reason why Squarehead, an excellent English wheat which has been used for the progressive improvement of the native varieties, but which, coming from less northerly districts, is more susceptible to cold, gave, in 1916, yields in grain inferior to those of native Swedish wheat (see Table I).

In 1890 the author, by individual selection, was able to isolate two lines, Grenadier and Extra Squarehead I, the first of which is distinguished by the quantity and quality of grain produced, as well as by the strength of its stems, the second by its resistance to cold and rust. By crossing these, so as to unite their qualities in one individual, he obtained Extra Squarehead II, which is superior to both the parents.

TABLE I. — *Relative indices of productivity of different varieties of winter wheat.*

Southern Sweden	Central Sweden (comparison with Svalöf)			
		Svalöf	Linköping	Utluna
Pansar . . . . . 140				
Fylgia . . . . . 135	0 826 Thule III . . . .	—	—	125.0
Sol II . . . . . 135	0 825 Thule II . . . .	128.5	121.1	113.6
Smaa . . . . . 131	0 823 . . . . .	113.4	111.7	108.8
Sol I . . . . . 131	0 200 Renodlad Square-			
Extra-Squarehead II . . 129	head . . . . .	124.0	107.8	100.4
Kotte . . . . . 128	0 700 Native Swedish .	100.0	100.0	100.0
Grenadier III . . . . 125	0 820 Thule I . . . . .	120.1	112.0	99.7
Grenadier I . . . . . 121	0 325 Pudel . . . . .	119.0	111.0	90.7
Wilhelmina . . . . . 115	0 406 Bore . . . . .	122.4	104.4	82.5
Extra-Squarehead I . . 112				
Native Swedish wheat . 100				
English Squarehead . . 99				

In the relative indices of productivity a fairly good position is held by the Sol variety, derived by individual selection (pure line) from a Swedish variety. More resistant to cold and earlier than Extra Squarehead, it

is much in demand among the farmers of Götaland, where the rather late southern types are not adapted to the climate.

The cross Extra Squarehead II  $\times$  Sol I gave the hybrid Sol II, which holds almost the first place in the scale of relative indices of productivity and is to be recommended on account of its specific resistance to lodging.

From the native Swedish wheat by pure strains was obtained, in 1890, besides the Sol variety, the Kotte variety, also very resistant to cold and rust, but unsatisfactory on account of its bad quality grain and weak straw. By crossing it with Grenadier, M. EHLE (1) united in one type, called Pansar, the characters *productivity* and *resistance to lodging* of Grenadier, and the characters *resistance to cold* and *resistance to rust* of Kotte. Pansar wheat now gives yields which exceed by 40 % those of the native varieties. In 33 cultural tests in 1915 it gave in 7 cases more than 18  $\frac{1}{4}$  cwt. per acre, in 8 cases, less than 16 cwt. and in 18 cases between 16 and 18  $\frac{1}{4}$  cwt. per acre.

The cross Extra Squarehead II  $\times$  Småhvetet (early, productive Danish wheat) gave the hybrid Fylgia, which, in the north of Scania, has proved more productive and earlier even than Pansar.

To what extent is it possible to introduce into other districts of Sweden the varieties created at Svalöf? An answer to this question is found in Table I, which compares data obtained at Svalöf (southern Sweden) with those of Linköping and Ultuna (central Sweden); it shows that the varieties Renodlad Squarehead, Bore and Pudel, good at Svalöv, decrease rapidly in value as they go further north and, at Ultuna, are much inferior to native wheats. In 1904 M. EHLE crossed these (resistant to cold, ripening early) with the Pudel variety (productive, resistant to rust and lodging) and obtained successively the hybrids Thule I, Thule II and Thule III. The second, and the third even more, are excellent types for the north; at Ultuna, Thule III has a productivity index of 115, *i. e.* exceeding that of the native types by 25 %.

To sum up, at the present time Pansar and Fylgia combine, in good proportions, the characters *productivity* and *resistance to unfavourable meteorological phenomena*, but it has not yet been possible to unite in one type *all the valuable characters* of the parents to the exclusion of *all their defects*, so that new improvements still remain to be obtained, it is hoped, by the experiments now in progress.

SPRING WHEAT (2). — Spring wheat must both give a good yield and ripen early. This second condition is realised by the native wheats, but not the first. The selection of native wheats by pure strains, undertaken in 1890, gave the varieties Vårpår and Svalöfs Kolben. By crossing these with 0201 (a productive, but inferior quality type of Squarehead), two good hybrids were obtained which could be advantageously grown in Scania.

A different series of experiments is in progress for the southern districts. From among the descendants of the hybrid Kolben  $\times$  native Dalarne wheat,

(1) See R. March, 1916, No. 286. (Ed.) — (2) See R. Sept., 1917, No. 806. (Fd.)

was isolated a line which, while very early, produces on an average 8 % more than Kolben. By representing the productivity of Kolben by the index 100, the following indices are obtained for the other above mentioned varieties ; —

Vårparl . . . . .	107.5	Vårparl X 0201 . . . . .	110.9
0201 . . . . .	111.7	Kolben X 0201 . . . . .	112.9

RYE (1). — The point of departure for the selections was Östgöta Grårag (grey rye of Östergötland), and the last variety obtained is Stjärn, which yields 40 % more than the original native type. A valuable variety is Förädlade Wasa (obtained by individual selection from the Wasa variety), because its resistance to cold allows it to be grown in the Norrland, beyond the belt of the Stjärn variety.

TABLE II. — *Relative indices of productivity of the different varieties of rye.*

Varieties	Svalöf 1907-1915	Östergötland 1910-1915	Ultuna 1910-1915
Stjärn . . . . .	139.4	120.4	118.0
Petkuser . . . . .	130.2	110.6	112.1
Bretagner . . . . .	127.6	107.8	99.1
Förädlade Wasa . . . . .	122.9	109.1	107.1
Schlanstedter . . . . .	118.7	—	109.9
Midsommar . . . . .	112.8	—	—
Wasa . . . . .	103.9	—	99.8
Östgöta Grårag . . . . .	100.0	100.0	—
Native Ultuna rye . . . . .	—	—	100.0

Varieties of rye which gave excellent results at Svalöf and Östergötland did very poorly at Ultuna, but now selection and hybridisation experiments with native rye have been undertaken, and it is hoped to obtain varieties better suited to the northern latitudes.

TABLE III. — *Relative indices of productivity of the different varieties of barley.*

Varieties	Scania		Östergötland 1909-1916	Ultuna	
	Svalöf 1909-1916	Various localities 1908-1916		1897-1910	1900-1916
Gullkorn . . . . .	107.6	112.6	113.5	122.2	116.6
Prinsess. . . . .	103.5	104.2	107.3	115.6	109.9
Hannchen . . . . .	101.4	103.5	108.3	120.1	—
Chevalier II. . . . .	94.4	97.5	102.2	111.1	105.3
Svanhals . . . . .	92.8	—	—	101.1	101.1
Svenskt Plymage . . . . .	—	—	—	100.0	100.0
Primus . . . . .	100.7	—	—	104.4	95.4
Native Swedish barley . . . . .	100.0	100.0	—	—	—
Flättring . . . . .	—	—	100.0	—	—

(1) See R. 1916, No. 287 (Ed.)

**BARLEY (1).** — For this cereal the results of selection are less obvious than for wheat and rye. It must, however, be noted: — 1) that, besides the yield, the quality of the grain for brewing must be largely considered, thus limiting the *quantitative* effects of selection; 2) that, at Svalöf, selection work was not begun with native types, but with the English barley Prentice, already improved, from which were obtained, by pure strains, the Princess variety, suited to light soils, and the Chevalier variety, suited to cold, heavy soils. Another variety, Hannchen, earlier and with strong straw, is one of the best, but is already surpassed by Gullkorn, a productive variety, resistant both to lodging and cryptogamic diseases.

**WHITE OATS.** — Selection was started with the Propsteier variety, already improved and productive, so that, like barley, the results do not, at the first glance, appear very remarkable. It is, however, sufficient to compare the last varieties obtained with the older, but still popular, native types, such as Ligowo II, Kubb, Förädlad Dala (selected Dala) to be convinced of their superior yield; thus, the new variety Kron produces 35 % more than Kubb. The variety Seger is also distinguished by the whiteness of its grain and Guldregn by the strength of its straw, the earliness and quality of its grain and its very thin glumes. The Svalöf oat varieties, unlike those of wheat and rye, also gave excellent results at Ultuna, as is seen from Table IV.

TABLE IV. — *Relative indices of productivity of the different varieties of oats.*

White oats			Black oats			
	Svalöf	Ultuna		Svalöf	Linköping	Ultuna
Kron . . . . .	106.3	102.7	Klock III . . .	121.3	114.4	101.8
Seger . . . . .	103.5	110.7	Stormogul . . .	120.7	111.8	99.9
Guldregn. . . .	102.5	107.9	Klock II . . . .	110.0	107.0	103.7
Propsteier . . .	100.0	100.0	Klock I . . . . .	109.5	—	—
Ligowo II . . . .	98.9	99.7	Fyris . . . . .	102.3	117.2	103.3
Förädlad Dala .	86.9	—	Tartarisk Plym .	—	75.5	88.7
Kubb . . . . .	78.4	—	Roslag . . . . .	100.0	100.0	100.0

**BLACK OATS (2).** — Selection was started with the varieties Roslag and Tartarisk Plym. From the former was obtained the variety Fyris (which holds first place at Linköping), from the latter, the varieties Klock I and Stormogul.

The cross Klock I × Guldregn (white) gave the hybrid Klock II. This, crossed in its turn with Stormogul, gave Klock III, which unites, in good proportion, the characters of the parents. The cross Klock II × Fyris has not yet given very definite results. Of importance are the attempts to cross the last varieties obtained at Svalöf with the native, northern types,

(1) See B. 1915, No. 369. (Ed.) — (2) See R. May, 1917, No. 122. (Ed.)

with the aim of uniting in one type the productivity and quality of the best varieties with the resistance to cold characteristic of the northern oats. The first result is the hybrid 01163 Dala  $\times$  Guldregn, superior to Dala in yield, resistant to cold, and earlier than Guldregn, which it could replace in the northern provinces. Very promising also are the hybrids Ligowo  $\times$  Nordfinsk = Björn, and Ligowo  $\times$  Nordland = Orion. All this hybridisation material has been sent for further study to the branch stations of Västernorrland, where the climatic conditions are more severe and difficult.

INCREASE IN THE PRODUCTION OF GRAIN DURING THE LAST 25 YEARS. — The new varieties created at Svalöf and distributed more or less widely towards the north, certainly produce much more than the native varieties, which they are gradually replacing entirely. This fact cannot fail to influence the production of grain, but there are no exact statistics which make it possible to determine to what extent the increased yield is due to the adoption of the new varieties, to the sowing of a larger area, or to the use of improved methods.

In the province of Malmöhus, the production of wheat which, during the five years 1889-1893, was 938 100 bushels, rose in 1909-1913, to 2 941 000 *i. e.* it was three times as great, and the largest increase was in 1899-1903, at the time when seed selected at Svalöf began to be used in extensive cultivation. Similar results were observed in the province of Kristianstad. With regard to increased production the districts of Sweden may be divided into three categories: —

- 1) Scania (provinces of Malmöhus and Kristianstad) . . . . . 200-300 %
- 2) Götaland and Värmland . . . . . 160 %
- 3) Svealand (provinces of Gotland, Dalarna and Gefleberg) . . . . . 25-30 %

In proportion as the north is approached the introduction of seed from Svalöf becomes more difficult and the results less certain, so that the increase in yield in the north is very limited.

It is interesting to determine in what proportions the three above-mentioned categories have contributed to the increase in production during the last 25 years. During the first five year period, 1889-1893, Svealand (3rd. category) holds the first place with 43.3 %, *i. e.* almost the half of the total production; then comes Scania with 34.5 %, and finally Götaland-Värmland with 23.2 %. During the last five year period, 1909-1913, the categories come in the following order: — Scania, 51.5 %; Svealand, 27 %; Götaland-Värmland, 21.5 %.

During the first five year period, 1889-1893, Sweden produced in all 3 717 671 imperial bushels of wheat; during the last, 1909-1913, it produced 7 494 838 bushels. In 1889-1893, 6 031 303 bushels of wheat were consumed, of which 50.6 % was supplied by the country and 49.4 % imported. In 1899-1903 the increased consumption was not compensated for by a proportionate increase in production, which does not represent more than 41.1 % of the total quantity consumed (8 998 073 bushels). Finally, in 1909-1913, in spite of the greater amount consumed (10 198 848 bushels), the wheat produced in Sweden rose again, and that imported fell to 46.4 % of the to-

tal consumption. By representing these fluctuations by relative indices the following figures are obtained : —

	1889-1893	1899-1903	1909-1913
Production . . . . .	1.01	1.2	2.0
Importation. . . . .	1.00	1.8	1.7

As is seen above, the effect of selecting superior types is first felt in the Scania district, where the climate is the same as that of Svalöf. The work of the branch stations, especially in Svealand, will allow the cultivation of wheat to be extended advantageously over large areas, where, at present, it cannot compete with barley and rye, and will help to decrease importation, seeing that the consumption curve tends to become horizontal. This rapid survey of the history of wheat in Sweden during the last 25 years, shows what results may be obtained, even in a short time, by the propagation of ultra-selected varieties.

For the other cereals—barley, oats and rye — it is more difficult to determine to what extent the varieties created at Svalöf have contributed to the increased production.

All the winter cereals, considered together, gave, in 1880, a yield in grain of 10.65 cwt. per acre, and in 1910, 13.38 cwt. The yield curve, which had remained more or less horizontal from 1885 to 1899, rose suddenly in 1909, just at the time when the seed from Svalöf began to be used in southern Sweden. As for the spring cereals, their yield per acre was 10.35 cwt. in 1880, 12.90 in 1910, and tended to increase, especially after 1905, that is to say, was in full keeping with the work of the main station at Svalöf.

Finally, to give an idea of the financial results obtained by the propagation of selected wheat, it is sufficient to mention the following facts: — in the province of Malmöhus alone, Pansar and Fylgia wheats, by increasing the yield by 7-8 %, gave a profit of about 1 million *crowns*, whereas Klock III oats, which yield 12 % more than Klock I, gave a profit of almost 4 million *crowns*, the cost of production remaining identical.

144 - **Linked Quantitative Characters in Wheat Crosses.** — FREEMAN, GEORGE F., in *The American Naturalist*, Vol. LI, No. 611, pp. 683-689, V tables. New York, November, 1917.

As the varieties of hard wheat and soft wheat used in the crosses described differ in having a number of visible characters exceeding that of the chromosomes (8) in the sexual cells, it was thought probable that a genetic linkage (1) of some of these might be found. The author

(1) Linkage was discovered in 1906 by BATESON and PUNNETT, who called it genetic coupling. By crossing the *Pisum sativum* varieties with purple flowers and long pollen grains with other varieties with red flowers and round pollen grains, it is seen that the 2 characters derived from each parent tend to be transmitted *coupled*, as if the respective determinants were found in one and the same chromosome. Cf. MORGAN, STURTEVANT, MULLER and BRIDGES, *The Mechanism of Mendelian Heredity*, pp. 48-77. London, Constable and Co., Ltd., 1915. — On this subject see R. January, 1918, No. 29. (*Ed.*)

undertook a study in order to determine if such a linkage exists between the texture of the grain (translucency or opaqueness) and the shape of the head determined by the ratio *width: thickness* (flattened heads and square heads).

One of the parents, No. 1, had hard, translucent grains and a flattened head; the other, No. 35, had soft, opaque grain and a nearly square head.

The hybrids of the  $F_1$  (1914) were intermediate to the two parents, both in the shape of the head and the texture of the grain (See Table I). In the  $F_2$  were found every possible degree of intergradation between the hard and soft grained variety. In order to facilitate the classification of the grains the author divides them into three groups: —

1st. Group: — Grains approximately resembling those of hard wheat. Hardness = 100.

2nd. Group: — Grains approximately resembling those of soft wheat. Hardness = 0.

3rd. Group: — All intermediate grains. Hardness = 50.

This classification allows the degree of hardness for each plant to be determined with facility. Thus, a plant having 60 % hard grains, 30 % intermediate grains, and 10 % soft grains, would be classified as follows:

$$(0.60 \times 1.00) + (0.30 \times 0.50) + (0.10 \times 0) = 0.75, \text{ or } 75 \%$$

Having classified the grains in this manner, the plants themselves may be divided into three groups.

	Percentage of hardness
1st. Group: — Hard wheats	over 66 $\frac{2}{3}$
2nd. Group: — Intermediate wheats	33 $\frac{1}{3}$ to 66 $\frac{2}{3}$
3rd. Group: — Soft wheats	less than 33 $\frac{1}{3}$

**CORRELATION BETWEEN THE TEXTURE OF THE GRAIN AND THE SHAPE OF THE HEAD.** — The flatter a head is, that is to say, the more its width exceeds its thickness, the higher will be the ratio or quotient obtained by dividing the first by the second. Is there any correlation between the degree of hardness of the grain and the value of this quotient? Table I gives, on this subject, data obtained in 1914 for the parents No. 1 and No. 35 and their  $F_1$  hybrids whereas Table II summarises the results concerning: 1) the parents and hybrids of  $F_2$  in 1915; 2) the parents and hybrids of  $F_3$  in 1916.

Tables I and II show there is a marked correlation between the texture of the grain and the shape of the head: the hardness of the first increases progressively in proportion as the ratio *width: thickness* increases in the second. Are we here concerned with a true genetic correlation, or a simple physiological correlation due to the fact that long, thin, hard grains, poor in starch, thus less capable of filling the glumes than are soft, well plumped grains, rich in starch, tend to form a flattened head? This problem may be solved in various ways: —

1) In the pure line of hard wheat No. 1 are always found soft grains, the number and proportion of which vary with the individual. Those plants producing a *smaller* proportion of soft grains have not more flattened heads

TABLE I. — Data concerning the two parents and their hybrids of  $F_1$  (1914)

	Value of ratio width : thickness															Total number of plants	Average value of ratio of width thickness	Character of grain
	Number of plants.																	
	0.60 to	0.70 to	0.80 to	0.90 to	1.00 to	1.10 to	1.20 to	1.30 to	1.40 to	1.50 to	1.60 to	1.70 to	1.80 to	1.90 to	2.00 to			
Hard wheat No. 1 . . . . .	—	—	—	—	—	3	7	12	46	34	23	21	—	4		150	1.63	Hard
Hybrid No. 1 × No. 35 . . . . .	—	—	—	—	1	1	5	4	9	12	3	4	—	—		39	1.56	Intermediate
Soft wheat No. 35 . . . . .	1	4	3	1	2	1	—	—	—	—	—	—	—	—		12	0.88	Soft

TABLE II. — Data concerning the two parents and their hybrids of  $F_2$  (1915) and  $F_3$  (1916)

	1915			1916			Character of grain
	Total number of plants	Average value of ratio of width thickness	Character of grain	Total number of plants	Average value of ratio of width thickness	Character of grain	
Hard wheat No. 1 . . . . .	298	1.57	Hard	253	1.45	Hard	Hard
Hard wheat No. 1 . . . . .	352	1.55	Intermediate	55	1.50	Intermediate	Intermediate
Hybrid No. 1 × No. 35 . . . . .	693	1.55	Hard	2 275	1.59	Hard	Hard
Hybrid No. 1 × No. 35 . . . . .	1 226	1.29	Intermediate	1 291	1.33	Intermediate	Intermediate
Hybrid No. 1 × No. 35 . . . . .	332	1.11	Soft	963	1.24	Soft	Soft
Soft wheat No. 35 . . . . .	166	0.95	Soft	241	1.04	Soft	Soft



than those producing a *larger* proportion of soft grains, as would be the case in physiological correlation.

2) There are varieties of hard wheat with square heads, and varieties of soft wheats, such as Little Club, with rather strongly flattened heads.

3) Plants which have an abnormal correlation between texture of the grain and the shape of the head transmit it to their descendants, as is shown by the figures for 1915 and 1916 given in Table III. In this case physiological correlation can play no part, whereas the phenomenon could easily be explained by genetic correlation, by the theory of exchange of elements between chromosomes as expressed by MORGAN's "cross over" theory (1). In any case, it cannot be a question of physiological correlation.

TABLE III. — *Inheritance of non-conformity to usual correlation between the shape of the head and the texture of the grain.*

Number	Parents (1915)		Descendants (1916)	
	Ratio <i>width: thickness</i>	Per cent hardness	Ratio <i>width: thickness</i>	Per cent hardness
132	0.93	98	1.34	88
169	1.10	50	1.24	73
210	1.20	50	1.35	93
232	1.25	100	1.33	86
239	1.33	60	1.30	88
263	1.00	64	1.17	61
279	1.27	50	1.35	79

It may be objected that, if there were a constant genetic link between the characters "shape of head" and "texture of grain", the linkage should be complete, whereas, on the contrary, there is considerable regression. This objection may be met by the observation that, apart from the fact that these characters are *quantitative*, and, therefore, subject to fluctuation round a mean, it may be admitted that the genetic factor for the texture is linked only with *one* of the factors determining the shape of the head. This would result in the partial correlation found.

CONCLUSION. — The data presented seem to show that the two characters, "hardness of grain" and "high ratio *width: thickness*" derived from the hard wheat parent No. 1, tend to come out together in the segregates of the  $F_2$  and  $F_3$  generations, *i. e.*, that there is genetic linkage between one or more of the factors (genes) controlling the grain texture and head shape in the two varieties employed as parents.

145 — Selection of "Kanred" a New Wheat Variety, in Kansas, U. S. A. — See No. 159 of this Review.

(1) See R. January, 1918, No. 29 (*Ed.*)

146 - Studies on the Contamination of the Pollen of Rye with the Help of "Indicator Plants" in Sweden. — HERIBERT-NILSSON, N. (Seed Selection Station of Weibullsholm, near Landskrona, Sweden), in *Zeitschrift für Pflanzenzuchtung*, Vol. V, Pt. 2, pp. 89-114, fig. 7-16, V tables. Berlin, 1917.

In his experiments on the selection of rye at the above mentioned station, the author uses a method differing in many respects from that usually followed; instead of sowing the descendants of the selected plants side by side, he scatters them in fields of wheat or fodder Gramineae in order to prevent their crossing.

In such work it is necessary to determine the manner and proportion in which the pollen of a plant, or group of plants, when carried by the wind, may reach the flowers of other plants, even if they be at a considerable distance. This may be done in three ways: —

- 1) The determination of the percentage of flowers setting in plants almost completely self-sterile, cultivated apart.
- 2) Direct collection of the pollen.
- 3) The use of "indicator plants" ("indicators").

1) PERCENTAGE OF FLOWERS SETTING. — In normal rye plants this is, on an average, 5 %. Higher averages, exceeding 10 %, may be attributed to contamination by other plants, or groups of plants. According to the author's observations, plants separated from each other by a distance of about 30 metres may be considered as practically isolated. Isolated plants at the same distance not of one plant, but of a group of plants (covering an area of about 0.5 square metres), are exposed to contamination at the rate of 10 %, bringing the percentage setting up to 15 %.

2) DIRECT COLLECTION OF THE POLLEN. — This is done by means of glass slides covered with liquid paraffin, placed at various distances from the rye-plot in the direction of the prevailing wind.

3) THE USE OF "INDICATORS". — In 1913, during work on the selection of the Danish variety of rye, Brattingsborg, the author noticed a plant distinguished, even when fairly ripe, by the persistence of chlorophyll in the stem, leaves and glumes, thus having the appearance of a wild grass. The green parts of the plant, then, *do not ripen* (1).

Hybridisation experiments with the normal type showed this "non-ripening" character to be recessive, the  $F_2$  individuals being distributed as follows: 296 normal to 96 green (theoretically, 294 to 98), according to the Mendelian ratio 3 : 1. As this green type is very rare (less than 1 in a million) and recessive, it is particularly well adapted for use as an "indicator" very sensitive to contamination. By studying the descendants of a given individual of this type it is possible to determine exactly the seeds arising from self-fertilisation and those arising from cross-fertilisation (contamination): the former will produce "green" plants, whereas the latter, fertilised by the normal dominant type, will produce normal individuals exclusively. It is, therefore, impossible to find a more exact instrument for measuring contamination.

(1) On the ripening of cereals see No. 141 of this Review. (Ed.).

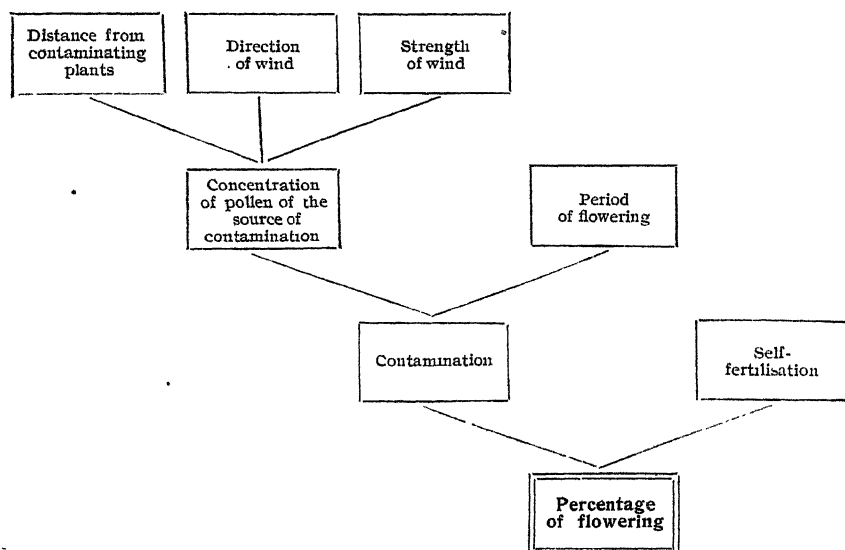
By applying this method it was found that 10 % of the isolated rye plants, at a distance of 50 metres from plots (rye) measuring 1 to 2 square metres, are subject to contamination. The larger the plots, the greater is the danger of contamination, as is shown by the following figures with regard to a rye plot measuring 3 500 square metres :

Distance between isolated plants and plot	Percentage of contamination
50 metres . . . . .	51.4 %
250   "   . . . . .	46.3
350   "   . . . . .	29.7
400   "   . . . . .	19.0

The use of "indicators" allows the effect of contamination on a whole crop to be studied. This is impossible by the usual methods owing to the impossibility of distinguishing between normal plants from self-fertilised seeds and normal plants from cross-fertilised seeds. It was thus possible to determine that the effect of contamination by the 3 500 square metre plot on a group of 20 "indicators" 60 metres away, was 37.3 % *i. e.*  $\frac{1}{3}$  rd. less than the effect on isolated plants. This difference is explained by the fact that the pollen of 20 plants in a group has a marked protective action.

The fertilisation of a group of plants exposed to contamination is obviously dependent on the state of the pollen mixture which spreads over the plot. The mass of pollen coming from a given group of plants becomes less dense in proportion as the distance it travels from its origin, or "source of contamination" is greater, in other words, its "concentration" is proportionately less strong. In a group A of plants exposed to contamination by another group B, the percentage of flowering depends both on the concentration of the pollen produced by the group A itself, and that of the pollen of group B, whereas the fertilisation of isolated plants depends almost solely on the concentration of the pollen of the "source of contamination", for their pollen concentration is almost equal to nil.

Other experiments have, moreover, shown that plants of the same group, or isolated plants situated at equal distances from the "source of contamination" may present widely differing percentages of contamination. Thus, for the 20 plants mentioned above figures were found varying between 9.6 and 68 %. These differences in one group may be explained as follows : The plants do not all flower at the same time ; in proportion as the absolute number of plants increases (and, consequently, the area of the plot), the total period of flowering increases and the amount of pollen spread over the neighbouring plants, or groups of plants, becomes thicker. The late-flowering plants exposed to contamination will, therefore, show a higher percentage of contamination than the early-flowering ones. The percentage of flowers setting of an almost self-sterile plant exposed to contamination is, therefore, dependent on many variable factors which may be represented by the following figure : —



The use of "indicators" also made it possible to show that the muslin bags placed over inflorescences to prevent access by foreign pollen do not have the desired effect. Rye pollen granules measure  $0.05 \times 0.06$  mm., and easily pass through the openings of this muslin, which have a diameter of 0.15 to 0.20 mm. Four "indicator" plants isolated by means of muslin gave descendants divided up as follows :

Indicators				Descendants			
Number of plants	Number of flowers	Number of seeds	Percentage of flowering	Number of plants	Contaminated plants (ripening normally)	"Indicator" plants (green)	Percentage of contamination
1045	74	59	79.6	28	14	14	50
1046	112	53	25.0	28	27	1	96.4
1047	50	15	30.0	6	4	2	67.7
1048	74	14	18.9	5	5	—	100

Of the descendants of the "indicator" 1045, half were produced by self-fertilisation, the other half by contamination. It is, therefore, a plant possessing a high degree of self-fertilisation, which shows that the pollen from the rye fields penetrates the muslin so abundantly that it may advantageously compete with the pollen of a self-fertile plant. In the other three cases the percentage setting is lower, an average of 25 %, and the average contamination is 83.3 %. Consequently, the majority of the plants (more than  $\frac{4}{5}$  ths.) are fertilised by foreign pollen which penetrates the protective hood, thus proving the inefficiency of muslin for isolation purposes.

147 - **Inheritance of Endosperm Colour in Maize.** — WHITE, ORLAND E., in the *American Journal of Botany*, Vol. IV, No 7, pp. 396-406, 4 tables, bibliography of 11 publications. Lancaster, Pa., July, 1917.

The factors determining the endosperm colour in maize have been studied by many authors (CORRENS, LOCK, HAYES, EMERSON, BURTT-DAVY, etc.). The author crossed varieties with yellow endosperm, California Golden Pop ( $Z_{14}$ ), with a Hopi variety and *Zea Caragua* ( $Z_{21}$ ), both with white endosperms. The results he obtained led him to form conclusions in part widely different from those of preceding authors who admitted the existence of two determinants of the yellow.

In the cross California Golden Pop ( $Z_{14}$ )  $\times$  *Zea Caragua* ( $Z_{21}$ ), the  $F_1$  hybrids had uniformly white endosperms, or, at the most, in certain cases, slightly yellowish ones. The cross California Golden Pop  $\times$  Hopi gave similar results.

Of 9 663 grains of the  $F_2$  generation of California Golden Pop ( $Z_{14}$ )  $\times$  *Zea Caragua* ( $Z_{21}$ ), 6 999 were white and 2 664 were yellow. Assuming the difference between these two varieties to be due to one single factor (monohybridism), the theoretical numbers would be 7 248 white and 2 416 yellow grains, in accordance with the Mendelian ratio 3 : 1. There is, therefore, a satisfactory agreement between the actual and theoretical values.

With regard to the yellow colour it should be noted : 1) it was lacking in uniformity, all shades from a dark yellow to a very light lemon yellow being present on the same ear ; 2) in some ears the yellow was principally confined to the base of the grain, nearest the point of attachment.

By crossing the hybrids  $Z_{14} \times Z_{21}$  of the  $F_1$  generation with the parent  $Z_{21}$  (*Zea Caragua*), white grains only were obtained.

In the  $F_1$  generation, of 6 208 grains, 4 703 were white and 1 505 yellow ; according to the Mendelian ratio 3 : 1, the figures should have been 4 656 white and 1 552 yellow. In this case the white, as well as the yellow grains, showed little uniformity in colour ; this is largely due to the segregation of factors affecting the texture and degree of translucency and opaqueness.

In all the experiments described above the inflorescences were always isolated by muslin or parchment bags (2 leaves). By leaving  $Z_{14}$  in contact with varieties with orange colour grain, fully exposed to cross fertilisation, ears with a large number of orange grains were obtained. From this it may be inferred that the orange grain variety is dominant to the yellow  $Z_{14}$  (California Golden Pop) variety. Under similar conditions,  $Z_{21}$  (*Zea Caragua*) always produced exclusively white grains.

Taking these data as a basis, the author explains the colour differences between  $Z_{14}$  and  $Z_{21}$  by the presence or absence of a single inhibitory factor, A, which prevents the development of the yellow colour, even in presence of the factor Y, which determines the yellow pigment. In the absence of this factor the grains may be either yellow or white. Four combinations are possible.

1) AAYY	white endosperm
2) AAyy	white       "
3) aaYY	yellow     "
4) aayy	white       "

By crossing these combinations with each other, the following colours would be obtained for the endosperm of  $F_1$  and  $F_2$ :

Cross	$F_1$	$F_2$
1 (white) $\times$ 2 (white)	white (AAYy)	all white
1 (white) $\times$ 3 (yellow)	white (AaYY)	3 white; 1 yellow
1 (white) $\times$ 4 (white)	white (AaYy)	13 white: 3 yellow
2 (white) $\times$ 3 (yellow)	white (AaYy)	13 white: 3 yellow
2 (white) $\times$ 4 (white)	white (AaYY)	all white
3 (yellow) $\times$ 4 (white)	yellow (aaYy)	3 yellow: 1 white.

The formula of the California Golden Pop ( $Z_{14}$ ) variety would be aaYY, that of the *Zea Caragua* ( $Z_{21}$ ) variety AAYY. All the common varieties with white endosperm would have the formula aayy, i. e., would possess neither the determining factor Y, nor the inhibitory factor A. These formulae would explain all the phenomena and combinations observed during the author's experiments.

148 - The Relation of Cob to Other Ear Characters in Maize. — GRANTHAM, A. E., in *Journal of the American Society of Agronomy*, Vol. IX, No. 5, pp. 201-217, 13 tables + 2 figs, bibliography of 4 publications. Washington, May, 1917.

This paper gives the results of a series of studies on the relation of the characters of the cob (size, weight, density) to those of the grain (depth, thickness, weight, yield), made at the Delaware Agricultural Experiment Station from 1910 to 1915. For the work were used 3 500 ears of maize of the Johnson County White variety, cylindrical in shape, with straight rows of kernels. Only the upper part of the ear deprived of the tips, so as to leave a cylindrical section 12 cm. long, was used. The following characters were studied:

- 1) Weight of section.
- 2) Number of rows.
- 3) Circumference of ear.
- 4) Thickness of kernel: determined by counting the number of kernels in 10 cm.: minimum number, 18; maximum, 32; average, 24.827  $\pm$  0.0229.
- 5) Weight of shelled grain or yield in grain: minimum 105 gm.; maximum, 285 gm.; average, 196.321  $\pm$  0.2639.
- 6) Weight of cob: minimum 15 gm.; maximum, 75 gm.; average, 36.500  $\pm$  0.083.
- 7) Circumference of cob: minimum, 7 cm.; maximum, 15 cm.; average, 10.571  $\pm$  0.011.
- 8) Depth of kernel: determined by the difference in the diameters of the cob and ear: minimum, 0.7 cm.; maximum, 1.9 cm.; average, 1.248  $\pm$  0.0015.
- 9) Weight of individual kernel, determined by counting the number required to weigh 10 gm.: minimum number, 18; maximum, 52; average, 27.805  $\pm$  0.0513.
- 10) Density of cob; determined by dividing its weight by its circumference; minimum, 0.12; maximum, 0.54; average, 0.328  $\pm$  0.0006.

The appended table give the coefficients of correlation between the various characters of the cob and those of the kernels, calculated by DAVENPORT's formula (1).

*Coefficients of correlation between the characters of the cob and those of the kernel.*

Characters		Coefficients of correlation
7) Circumference of cob and	5) Weight of grain per section. . .	0.4118 $\pm$ 0.0095
	6) Weight of kernel. . . . .	-0.0185 $\pm$ 0.0114
	8) Depth of kernel. . . . .	-0.1789 $\pm$ 0.0110
	4) Thickness of kernel. . . . .	-0.1053 $\pm$ 0.0113
9) Weight of cob and . . .	5) Weight of grain per section. . .	0.3064 $\pm$ 0.0103
	9) Weight of kernel. . . . .	-0.1837 $\pm$ 0.0110
	8) Depth of kernel. . . . .	-0.0747 $\pm$ 0.0113
	4) Thickness of kernel. . . . .	-0.1500 $\pm$ 0.0111
10) Density of cob and . .	5) Weight of grain per section. . .	-0.0728 $\pm$ 0.0113
	9) Weight of kernel. . . . .	-0.1959 $\pm$ 0.0111
	8) Depth of kernel. . . . .	-0.0039 $\pm$ 0.0113
	4) Thickness of kernel. . . . .	-0.0513 $\pm$ 0.0114

CONCLUSIONS. — 1) The *yield of grain* per ear increases with the circumference of the cob; the correlation between these characters is fairly high.

2) There is also a high correlation between the *yield of grain* and the *weight of the cob*.

3) The *depth of the kernel* increases with the *density of the cob*, but the correlation is slight.

In these three cases, contrary to the following ones, there is positive correlation.

4) An increase in the *density of the cob* tends to decrease the *weight of kernel*; the negative correlation is moderate.

5) There is a moderate degree of correlation between the following pairs of characters: *circumference of cob* and *depth of kernel*; *weight of cob* and *average weight of kernel*; *weight of cob* and *thickness of kernel*.

$$(1) \text{ DAVENPORT's formula is: } r = \frac{\sum D_L D_W}{\sigma_L \sigma_W}$$

where  $D_L$  represents the difference between the lengths and average length  
 $L_W$  " " " " the weights and average weight  
 $\sigma_L$  " " standard deviation of the length  
 $\sigma_W$  " " " " of the weight.

The maximum degree of *positive* correlation is expressed by the coefficient + 1; the maximum degree of *negative* correlation by the coefficient - 1; the absence of any correlation is represented by 0. Thus, the value 0.9 shows a very high positive correlation, whereas the value 0.1 shows a very low correlation. (Ed.)

6) There is slighter negative correlation between the *circumference of the cob* and *thickness of kernel*.

7) There is a low negative correlation between the pairs of characters: *weight of cob* and *depth of kernel*; *density of cob* and *yield of grain*.

8) The negative correlation between *density of cob* and *depth of kernel* is very slight.

9) There is practically no correlation between the *circumference of the cob* and the *weight of the individual kernel*.

There are, then, in certain cases, clear and well-defined relationships between the characters of the cob and those of the kernels, so that measurements of the cob might be a valuable aid in the selection of maize.

149 - On Abnormal Ears of Maize Obtained from Seeds Treated with Copper. — JUNGELSON, A., in *Revue Générale de Botanique*, Vol. XXIX, No. 344-345, pp 241-248 + 261-285 + 1 fig. + plates 17-21. Paris, 1917.

The experiments described were carried out in 1914 and 1915 to determine the effect of copper salts on the growth of cereals, and of maize in particular.

The 1914 experiments showed that treating maize seed with copper salts had the following effects: —

1) The germinating power of the seeds is weakened.

2) The poisoning of the seedlings is often shown by the appearance of a bluish streak on the leaves.

3) The growth of the plants is slower and flowering is, consequently, retarded.

4) Poisoning of the seeds may give the plants issued from them special capacities, tendencies to vary, shown by the appearance of abnormal ears, which, by their own characters, and by those of the grain they contain, are removed from the racial type.

5) These new characters are faulty and retrogressive, and the injurious effects increase with the increased poisoning of the seed — greater length of time of poisoning, closer contact of the poison and albumen as a result of previous mutilation.

The 1915 experiments gave the following complementary conclusions: —

6) Different copper salts have the same effect.

7) The facility of the plants to give abnormal ears varies with the concentration of the copper solution in which the seed has been placed.

8) Copper has no well-defined effects, and seeds treated in an identical manner give birth to different anomalies.

9) The tendency to vary of a plant from poisoned seed may be shown by qualitative or quantitative effects, by the appearance of multiple anomalies, or of more uniform ones in greater number.

10) The new characters of the seed and the grain are not stable, and do not seem to reappear in the descendants.

11) The tendency to vary of the parent-plant is fixed in the seed which produces irregular and retrogressive ears.

PRACTICAL RESULTS. — A) The copper treatment, used in agriculture to protect seeds against cryptogamic diseases, may have an accessory and in-



jurious influence. The specific characters of the varieties cultivated may, under this influence, disappear and be modified in an undesirable sense. The deterioration of local varieties of cereals, of which farmers have so frequently complained during recent years, may be partly due to this anti-cryptogamic treatment, and may prove a serious obstacle to the improvement and selection of the desired characters. It is even possible that chemical poisoning may produce deeper and more lasting results than those obtained in the author's experiments, and that poisoning or development in a medium which is not the customary one may be the cause of diverging types or of deformities.

B) By the action of peculiar and graduated chemical influences easily adapted to experiment, it may be possible to throw some light on the natural factors of evolution, and perhaps also on the mechanism of racial variation. It is of no account if pathogenic actions are concerned, for it is still unknown whether they may not be direct or indirect causes of the variation and evolution of plant species or forms.

150 - **Correlations between the Chemical and Morphological Characters of Sorghum.** — See No. 140 of this Review.

151 - **An Interesting Bud Variation in the Duchess Apple.** — DORSEY, M. J., in *The Journal of Heredity*, Vol. VIII, No. 12, pp. 565-567, fig. 9. Washington, December, 1917.

WILLIAM BARDWELL found in his orchard near Excelsior, Minn., a Duchess apple which differs from the others of the same variety in its deeper red colour and harder skin.

Typical Duchess apples are pale yellow, more or less covered with irregular dark red streaks overlying lighter irregular blotches. The sport has the same yellow background, but is covered with a solid, dark red colour on exposed parts, shading, at the apex, into a lighter red overlaid with darker streaks. The skin, being harder, is more resistant during cooking. It is probably a case of bud variation which, since it shows the same productiveness and quality as the parent plant, might be successfully propagated by grafting, and form a new type of great market value owing to its fine colour.

It was in this manner that Collamer and Hitchings arose from Twenty Ounce, and that Banks arose from Gravenstein, all being forms characterised by a deeper colour. Banks is usually called Red Gravenstein, and, similarly the new Duchess type might be called Red Duchess.

152 - **A Bottle Necked Lemon.** — SWINGLE, LEONHARDT, in *The Journal of Heredity*, Vol. VIII, No. 12, pp. 559-560, 1 fig. Washington, December, 1917.

Bud sports are much more frequent in the citrus family than is supposed, and are of importance in the improvement and standardisation of varieties.

In a Eureka orchard near Corona, Cal., the author observed a limb sport which had grown till it comprised a large part of the tree. It was distinguished by its bottle-necked fruit and narrow, sharply pointed leaves, resembling those of the willow or peach.

A search led to the discovery of several other identical cases. There

is no transition between the normal part of the tree and the sporting branch. The apparent correlation which is always found between the bottle-necked fruit and the narrow pointed leaves, is of interest.

The fruit of these branches is of inferior quality and market value. This shows the necessity of careful pruning and the rejection, for grafting purposes, of buds or scions showing such variations to however slight a degree.

CEREAL  
AND PULSE  
CROPS

153 - Cereal Cultural Experiments made in 1916 at the Agricultural Station of Flahult, Sweden. — VON FEILITZEN, HJALMAR, in *Svenska Mosskulturforenings Tidskrift*, Year XXXI, No. 6, pp. 465-469. Jönköping, 1917.

1) SPRING RYE AND WHEAT, BARLEY AND OATS. — In yield of grain oats hold the first place, followed by barley, rye and wheat.

	Variety	Beginning of earing	Duration of growing period, days	Grain Yield	
				Cwt. per acre	Compared with that of oats = 100
Oats. . . . .	Sege	July 25	138	21.16	100
Barley . . . .	Korn	July 15	119	19.70	93
Rye . . . . .	Primus	June 25	131	15.80	75
Wheat . . . .	Jätte	July 20	138	16.20	77

As in the previous year Gulkorn barley gave a yield much superior to that of Primus; taking that of Primus as 100, the values 140, 167, 114 are obtained for the years 1914, 1915, 1916, respectively.

2) COMPARATIVE EXPERIMENTS WITH DIFFERENT VARIETIES OF OATS. — The Kron variety holds the first place with a yield of 21.13 cwt. of grain per acre; next comes Probsteier with 20.08 cwt. The two new Svalöf hybrids, Orion and Björn, specially designed for the northern districts, gave, in 1916, a yield slightly higher than that of Tysk Mosshafre (a German oat for peaty soils).

	Straw per acre Cwt.	Grain per acre Cwt.	Weight per quarter lbs.	Weight of 1000 grains gms.	Per cent- age of grain	Number of days from sowing to appearance of inflores- cences	Duration of growing period days
<i>White Wheats:</i>							
Kron . . . . .	43.51	21.22	303.1	34.5	73.7	93	146
Probsteier . . . . .	43.60	20.08	296.0	34.6	73.6	92	146
<i>Black Wheats:</i>							
Tysk Mosshafre . .	37.87	18.97	311.4	30.5	73.1	62	129
Orion . . . . .	41.76	19.42	324.2	34.5	73.0	84	130
Björn . . . . .	41.95	19.38	324.8	30.1	74.2	86	130

154. Increased Production of Cereals in Sweden. — See NO. 143 of this Review.

~~155-154~~

155 - **The Colour Classification of Wheat.** — HAYES, H. K., BAILEY, C. H., ARNY, A. C. and OLSON, P. J. (Committee of the Minnesota Section of the American Society of Agronomy), in the *Journal of the American Society of Agronomy*, Vol. IX, No. 6, pp. 281-284. Washington, D. C., September, 1917,

The colour of wheat is due to the joint effect of two factors: — 1) The presence or absence of a brownish-red or orange-yellow pigment in the bran layer; 2) the physical condition of the endosperm cells. These latter may be corneous or starchy, according to the density of the cell contents or the relative amount of space occupied by air cavities or vacuoles. The confusion which has arisen with regard to the colour classification of wheat is probably due to the use of a single term to describe the combined visual effect of these two characters.

The presence or absence of a red pigment in the bran layer is of little importance in indicating milling value; but the density of the endosperm is of great importance. Pigmentation is definitely inherited and appears under widely varying environmental conditions. Although somewhat modified by climatic conditions, the intensity of pigmentation is a varietal character. With the same degree of pigmentation, a starch kernel has a lighter appearance than a corneous kernel, but there is no difficulty in distinguishing a starchy pigmented kernel from a starchy white kernel.

If inheritance be regarded as a characteristic manner of reacting to a certain environment, it may be said that the physical condition, whether corneous or starchy, is an inherited character. This, however, does not apply to the density of the endosperm, which is very dependent upon environmental conditions, a fact which must be borne in mind in classification in view of its relation to milling qualities.

The authors, therefore, propose the following classification: —

Two columns are necessary: 1) *Pigmentation*; 2) *Physical condition or density*.

Under *pigmentation* it is proposed to use the term "red" to show the presence of a brownish-red pigment in the bran layer. This is to be modified by the term "light" when the degree of pigmentation is less than is usual in red wheats. Although the pigment may not be entirely absent from the bran layer of the so-called "white wheats", it is so nearly so that the term "white" is proposed in classifying them. It is recognised that a corneous kernel with a non-pigmented bran layer will not appear perfectly white. The colour of the bran layer is not affected by the density of the endosperm, although the visual appearance due to the two factors is influenced by the relative endosperm density.

Under *physical condition or density* are proposed 4 terms to denote the various gradations of endosperm density: 1) corneous; 2) sub-corneous; 3) sub-starchy; 4) starchy.

In the first group, *corneous*, would be included only the uniformly corneous sample.

The second group, *sub-corneous*, would include samples whose kernels approach either of the following conditions or a combination of both: —

a) samples containing  $\frac{2}{3}$  corneous kernels and  $\frac{1}{3}$  starchy or sub-starchy kernels; b) samples in which nearly all the kernels approach the corneous group, the greater part having only a small percentage of starchy endosperm.

The third group, *sub-starchy*, would consist of kernels  $\frac{2}{3}$  of which are starchy and  $\frac{1}{3}$  corneous, or kernels which contain a small amount of corneous matter with the larger part of the endosperm starchy or a combination of these two conditions.

The fourth group would be limited to uniformly starchy material.

It is recognised that samples intermediate to two of these groups will often be found; in such a case they must be placed in the group they most closely resemble; the signs + and - may be used to show they are slightly above or below the average of the group in which they are placed.

**156 - The Effect of Sodium Nitrate Applied at Different Stages of Growth on the Yield, Composition and Quality of Wheat.** — DAVIDSON, J. and LE CLERC, J. A. (Plant Chemical Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture), in the *Journal of the American Society of Agronomy*, Vol. IX, No. 4, pp. 145-154. Washington, D. C., April, 1917.

LE CLERC and LEAVITT (1) have shown that the variation in nitrogen content of wheat is independent of the original nitrogen content of the seed used. This conclusion is confirmed by other work which has proved that the soil is a minor factor in this variation, so that it appears that the principal factor, within the limits of these experiments, is climate. It remains to be found which factor, or combination of factors, of climate (rainfall, sunshine, altitude, temperature) are the principal causes of such variation, and whether climate affects the metabolism of the plant directly, or indirectly by modifying the amount of plant food in the soil.

The work described in this paper was undertaken to study this question. It was thought that climate might be the cause of the variation of available nitrates at different stages of growth and it therefore seemed advisable to study the effect of the application of sodium nitrate at these different stages. The experimental plots measured 1 square rod each, and the nitrate was applied, either in solution or in the solid state, at the rate of 320 lbs. per acre in 1, 2 and 3 lots at the following periods: — 1) when the crop was about 2 inches high; 2) at heading; 3) milk stage.

The results show, above all, that the addition of sodium nitrate at the early stages of growth stimulates the vegetative growth and, consequently, increases the yield. Though the presence of sodium nitrate at the time of heading gives a better quality grain as regards colour and protein content, it does not affect the vegetative growth. At the milk stage, sodium nitrate has no effect on the yield, quality or protein content of the grain. The same results were obtained whether the nitrate was applied in solution or in the solid state; except during the first stage, when the use of nitrate in

(1) LE CLERC, J. A. and LEAVITT, S., Trilocal Experiments on the Influence of Environment on the Composition of Wheat, in U. S. Dept. of Agr., Bureau of Chemistry, Bull. 128, pp. 18. 1920. (Author).

solution gave higher yields, probably on account of the better distribution of the fertiliser in this form.

The experiments also confirmed the negative correlation between the nitrogen content and yellow colour of the grain; potassium chloride alone appears to increase this colour, but does not effect either the vegetative growth or the chemical composition of the grain.

**157 - Experiments with Wheats at Verrières, Seine-et-Oise, France.** — De VILMORIN JACQUES, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. II No 38, pp. 1077-1085. Paris, December 5, 1917.

In this paper are given the results of experiments with wheats begun in 1917 at Verrières by M. PHILIPPE DE VILMORIN, and continued after his death by the author.

**F. — SPRING WHEATS.** — The following seven varieties were studied in 1917: *Aurore*, *White Fife*, *Manitoba*, *Red Fife*, *Kolben*, *Mars rouge sans barbes*, *Marquis*.

The *Manitoba* wheat used for comparison was from the old VILMORIN stock, received from the Corbeil mills in 1900, and grown ever since at Verrières.

The experiments were divided into two parts:

1) *Aurore*, *Manitoba*, *Red Fife*, *Marquis* and *Kolben* were compared. These wheats were classified as follows: —

Earliness	Yield
1st. — <i>Aurore</i>	1st. — <i>Aurore</i> with 46.20 lbs* per 120 sq. yds.
2nd. — <i>Marquis</i>	2nd. — <i>Kolben</i> » 31.46 » » » » »
3rd. — <i>Manitoba</i>	3rd. — <i>Marquis</i> » 30.25 » » » » »
4th. — <i>Kolben</i>	4th. — <i>Manitoba</i> » 23.98 » » » » »

In the 1917 yield tests *Kolben* took a good place, much higher than that it had held previously.

2) The number of days elapsing between the date of sowing and that of harvesting were:

Sown on March 1.	Sown on March 15
<i>Aurore</i> . . . . . 148 days	<i>Marquis</i> (received and sown on the 20th. only) . . . . . 136 days
<i>Mars rouge sans barbes</i> . . . . . 156 »	<i>Aurore</i> . . . . . 138 »
<i>Manitoba</i> . . . . . 159 »	<i>Mars rouge sans barbes</i> . . . . . 144 »
<i>Red Fife</i> . . . . . 162 »	<i>Manitoba</i> . . . . . 147 »
<i>White Fife</i> . . . . . 162 »	<i>White Fife</i> . . . . . 147 »
<i>Kolben</i> . . . . . 169 »	<i>Red Fife</i> . . . . . 151 »
	<i>Kolben</i> . . . . . 153 »
Sown on April 1.	Sown on April 15.
<i>Aurore</i> . . . . . 129 days	<i>Aurore</i> . . . . . 114 days
<i>Marquis</i> . . . . . 131 »	<i>Marquis</i> . . . . . 114 »
<i>Mars rouge sans barbes</i> . . . . . 135 »	<i>Mars rouge sans barbes</i> . . . . . 116 »
<i>Manitoba</i> . . . . . 138 »	<i>Manitoba</i> . . . . . 116 »
<i>Kolben</i> . . . . . 138 »	<i>White Fife</i> . . . . . 116 »
<i>Red Fife</i> . . . . . 114 »	<i>Red Fife</i> . . . . . 120 »
<i>White Fife</i> . . . . . 144 »	<i>Kolben</i> . . . . . 120 »

*Aurore* wheat leads in every respect, being very closely followed by *Marquis* wheat.

*Aurore* wheat. — This wheat is of Australian origin, a hybrid of the *Jacinthe* and *Ladoga* varieties obtained in Australia. It was imported in 1892 in the *VILMORIN* collection. One plot of *Aurore*, sown on May 1st., was harvested on July 31st., after exactly 3 months, with a yield of 1177 lbs. for 25 ares (17 cwt. per acre), in medium soil, with average cultural methods. Sown during the first days of March, *Aurore* gave, in 1916, a fine yield of over 26 cwt. per acre. In 1917, however, though sown, under bad conditions, it only gave a yield of 17 ½ cwt. per acre. *Aurore* wheat is an excellent spring wheat for France.

*Marquis* wheat. — This variety, obtained in Canada by DR. CH. SAUNDERS, is rapidly taking the place of all other varieties in that country. Its earliness, surpassed by no other wheat in America, and which, in the experiments in question, is very near that of *Aurore*, gives it a great value. The advantage it has in being a selected wheat, and not mixed, like *Manitoba* is very appreciable. It would be useful to grow it in France on account of its earliness and yield.

*Mars Rouge sans barbes* comes after *Marquis*, followed immediately by the series *Fife*, alias *Manitoba*.

II. — RESISTANCE TO COLD OF THE DIFFERENT VARIETIES OF WHEAT. — Observations on this point were made in the annual experiment on winter yields at Verrières. In this district the frosts continued almost without interruption from January 20th. to February 15th., sometimes reaching — 16° C.

### *Classification in 1917 according to resistance to cold.*

#### 1. Varieties resisting well or hardly suffering.

- 1) *Rouge d'Atterch* (completely immune)
- 2) *Tererson* (resisted well, none lost)
- 3) *Dattel* (id.).
- 4) *Automne rouge barbu* (id.).
- 5) *Nouette de Lausanne* (id.).
- 6) *Épautre blanc sans barbe* (id.).
- 7) *Perle du Nuiscement* (a few plants only lost).
- 8) *Victoria d'Automne* (id.).
- 9) *Blanc des Flandres* (id.).
- 10) *Ble-Seigle* (id.).
- 11) *Crépi* (id.).
- 12) *Gros bleu* (id.).
- 13) *Briquet jaune* (id.).
- 14) *Lamed* (id.).
- 15) *Rouge d'Ecosse* (id.).
- 16) *Brownick* (id.).

#### 2. Varieties suffering but little.

- 17) *Grosse Tête* (barely 1/5 lost)
- 18) *Massy* (id.).
- 19) *Tererson à épi blanc* (id.).
- 20) *Chiddam d'Automne à épi rouge* (id.).
- 21) *Little Joss* (id.).
- 22) *Trésor* (1/4 lost).
- 23) *Blanc à paille raide* (id.).
- 24) *Blé Hybride No. 115* (lost 1/3).
- 25) *Blé Hybride No. 104* (id.).
- 26) *Blé Manitoba* (from Goldschidt, 1/3 lost).
- 27) *Mars de Suède rouge barbu* (1/3 lost)
- 28) *Géant du Milanais* (id.).

3. *Varieties suffering.*

- 29) Roseau ( $\frac{1}{2}$  lost).
- 30) Bordeaux (id.).
- 31) Bon Fermier (id.).
- 32) Japhet (id.).
- 33) Champlan (id.).
- 33-a) Blé Hybride No. 119 (id.).
- 34) Blé Hybride No. 120 (id.).
- 35) Hatif Inversable (id.).
- 36) Blé Hybride No. 134 (id.).
- 37) Blé Hybride No. 105 (id.).

4. *Varieties suffering badly.*

- 38) Noé ( $\frac{2}{3}$  frost bitten).
- 39) Bordier ( $\frac{3}{4}$  frost bitten).
- 40) Alliés (id.).
- 41) Blé Hybride No. 118 (id.).
- 41-a) Saumur d'automne (id.).
- 42) Rouge de Saint-Laud (id.).
- 43) Rieti (id.).
- 44) Odessa sans barbes (id.).
- 45) Engrain commun (id.).
- 46) Barbu a gros grain ( $\frac{7}{10}$  frost bitten)
- 47) Cazeaux ( $\frac{4}{9}$  frost bitten).

5. *Varieties completely or almost completely frost bitten.*

- 48) Rouge prolifique barbu (suffered very badly).
- 49) Chiddam blanc de Mars (id.).
- 50) Pithiviers (almost entirely frost bitten).
- 51) Touzelle rouge de Provence (id.).
- 52) Hérisson sans barbes (id.).
- 53) Mars rouge sans barbes (id.).
- 54) Richelle blanche de Naples (a few plants only remained).
- 55) Gironde (id.).
- 56) Blé Hybride de printemps No. 187 (id.).
- 57) Pétauielle blanche (id.).
- 58) Six-rowed Poulard (id.).
- 59) Poulard d'Australie (id.).
- 60) Richelle blanche hâtive (id.).
- 61) Saumur de Mars (completely frost bitten.).
- 62) Blé Hybride de printemps No. 192 (id.).
- 63) Blé Hybride de printemps No. 193 (id.).
- 64) Aurore (id.).
- 65) Mars barbu ordinaire (id.).
- 66) Mars rouge barbu (id.).
- 67) Pétauielle noire de Nice (id.).
- 68) Amidonnier blanc barbu (id.).
- 69) Amidonnier blanc amélioré (Alvargonzalez) (id.).
- 70) Miracle (id.).
- 71) Belotourka (id.).
- 72) Médéah (id.).
- 73) Pologne (id.).

The following results were obtained in experiments on "successive autumn sowing", in which various hybrids were studied and many known varieties were used for comparison.

. *Chi! am winter wheat (white ears).*

Sown on October 20 (almost entirely frozen).  
Sown on December 1 (resisted well).

*Blé des Alliés.*

Sown on October 20 (almost entirely frost bitten).  
Sown on December 1 (resisted well).

*Blé Aurore.*

Sown on October 20 (entirely frost bitten, except 3 plants).  
Sown on December 1 (very badly attacked).

This last observation was made only out of curiosity and is of no practical value as spring wheats are never sown in autumn.

158 - **Wheat Growing in Tuscany:** — FERRARI P, in *L'Italia Agricola*, Year **LIV**, No. 11, pp. 385-389. Piacenza, November 15, 1917.

In Tuscany, the production of wheat, as such, has relatively little importance, for the topographical conditions of the province are more suitable for the cultivation of woody plants (vine, olive, etc.), so much so

that, in many localities, the total production of the farm does not suffice for the consumption of the farm family. On the other hand, Tuscany produces seed of one of the best wheat varieties ("gentil rosso") which, when cultivated in the fertile plains of upper Italy, has considerably increased the unit production of this cereal.

Tuscany was the first region of Italy to improve the local varieties of wheat by careful selection, a process that has been practised since 1890.

Tuscan wheats are all soft varieties: —

"Gentil rosso": — most widely grown wheat in Tuscany; awnless; long, blond grain, tillers abundantly.

"Gentil bianco": — when mature, ear and grain are lighter coloured than those of the previous variety; awnless; seed not so long as that of "gentil rosso"; good cropper, especially in hill regions (650 to 1300 ft.).

"Calbigia": — ear coloured like that of "gentil bianco"; grain reddish, this is why, in several localities, the name "calbigia" is used as a synonym of "gentile", and local varieties are often called "calbigia bianca" or "calbigia rossa", according to the colour of the grain.

"Mazzocchio": — round ear, with long, stiff awns; does not tiller so well as the preceding varieties, and is best suited to hill regions; is less affected by shading by the olive and other trees, and is little liable to lodging; full, reddish grain, giving a good yield of flour that makes excellent bread.

Among other local varieties are: "grano rosso" (red wheat) and the bearded "cascola", chiefly grown in the provinces of Pisa and Grosseto; "civitella" with a long, white, bearded ear; "andriolo", bearded, suitable for hill regions. All these varieties are of secondary importance compared with "gentil rosso", which may be considered as the typical wheat of the greater part of Tuscany.

Amongst introduced varieties, *Rieti wheat* is grown in level regions where the crop is liable to rust. Some trials have been made of the *hybride inversable de Vilmorin* (Vilmorin's non-lodging hybrid) wheat in flat districts where the shade produced by trees is harmful.

On the author's suggestion the "R. Accademia dei Georgofili" of Florence opened, in 1890, a competition for bonuses for the selection of wheat seed, in order to improve local varieties. Owing to the good results of this competition, another was organised in 1895, always limited to local varieties. These competitions showed up the value of the "gentil rosso" and "gentil bianco" varieties, especially of the former. Many competitors showed that, by methodic seed selection, were obtained uniform seed characters, greater tillering power, a longer ear, a greater number of fertile spikelets, and, in consequence a greater unit yield. This is why many farmers of the Val d'Arno (province of Florence), among those who had won prizes at the competition, commenced the large scale production of "gentil rosso" for seed. In 1905, the Florentine "Consorzio agrario" commenced the sale in Tuscany and upper Italy, where "gentil rosso" was very successful. Afterwards, many farms sold "gentil rosso" seed wheat directly to the "Consorzi agrari" of Venetia, Lombardy and Emilia, the repre-



sentatives of which visited the crops before the harvest to ascertain their uniformity. Then the "Istituto per le sementi" was founded to deal particularly with the provision of and preparatory work for seed wheat, the diffusion of which was greatly helped by the "Federazione italiana dei Consorzi agrari".

In 1913 it was calculated that, in 18 provinces of Piedmont, Lombardy, Venetia and Emilia, the wheat "gentil rosso" was grown on 86 050 acres or 35 % of the total area under wheat (see *Il frumento in Italia*, Ministero di Agricoltura, Industria e Commercio, Ufficio di Statistica Agraria, pp. 33. Rome, 1914).

Allowing that the locally produced seed can be used for 5 years, about 70 000 quintals of the original wheat seed must be imported every year.

The example given by the "R. Accademia dei Georgofili" of Florence has been followed by the Bologna Agricultural Society, the R. Academy of Agriculture of Turin, the Treviso Agricultural Association, the Agricultural Committees of Catania and Pisa, the "Cattedra Ambulante di Agricoltura" of Piacenza, etc.

159 - "Kanred", a New Wheat for Kansas. — JARDINE, W. M., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 6, pp. 257-266. Washington, D. C., September, 1917

ORIGIN. — The new wheat, called Kanred, is the product of a single head selected in 1906 from Crimean (No. 1435 of the Office of Cereal Investigations, U. S. Department of Agriculture) by the Department of Botany of the Kansas State Agricultural College. In the autumn of 1906, 554 selected heads were sown, and 451 were harvested in the following season. These and 79 other selections were sown in single rows alternating with Kharkof wheat for purposes of comparison. In 1908, 533 selections were harvested, 122 of which were chosen for increase. In the autumn 10 rows of each of these were sown with alternate rows of Kharkof. In 1909, 89 selections were harvested, sown in rows as before, and, in 1910 the harvest, together with 100 other strains, was passed over to the Agronomy Department for further trial. From 1911 to 1916 several of the most promising selections, including Kanred, were grown in pots. From 1914 onwards Kanred was grown at the sub-station at Hays, Kansas, and in co-operative tests with farmers throughout the hard winter-wheat belt. Since 1915 it has been grown at the sub-stations at Colby and Garden City, Kansas. Milling and baking tests and chemical analyses of the most promising strains have been made each year since 1912.

CHARACTERISTICS. — Hard winter-wheat, bearded, with whitish, glabrous glumes and reddish grain of the well-known Crimean or Turkey type. In habit of growth and general appearance the plant and grain cannot be distinguished from Turkey and Kharkof unless it be in minute botanical differences which have not been determined. It usually heads and ripens somewhat earlier than Turkey and Kharkof, but this difference is not sufficiently constant for identification.

*Average yields and other Agronomic Data of Kanred,  
Turkey and Kharkof Wheats at Manhattan, Kansas from 1911 to 1916.*

Variety	Yield in bushels per acre	Date of heading	Date of ripening	Weight in lbs. per bushel
Kanred . . . . .	31.1	May 21.8	June 19	59.2
Turkey . . . . .	26.5	May 22.8	June 20.8	59.5
Kharkof . . . . .	25.9	May 23.1	June 21.2	58.3

In the tests carried out at the three above-mentioned sub-stations or in cooperation with farmers, Kanred always surpassed, in unit yields, the varieties compared with it, ripened before or at the same time as the other wheats, and appeared to bear the winter better.

*Average Results of Milling and Baking Tests made at Manhattan  
from 1912 to 1915.*

	Grain		Yield of flour %	Flour		Absorption, %	Maximum expansion, cc.	Oven rise cm.	Loaf volume, cc.	Colour	Texture %	Weight gm.	Wet gluten %	Dry gluten %
	Protein %	Moisture %		Protein %	Moisture %									
Kanred . . . . .	17.59	10.85	64.13	16.19	12.95	59.6	2150	5.6	1937	92.7	93.2	521	52.54	15.85
Kharkof . . . . .	15.84	11.63	63.26	14.32	13.18	60.7	2160	4.9	1877	92.5	93.0	529	45.90	13.98

160 - **Maize in Madagascar.** — REYNIER, F., in *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year II, No. 13, pp. 9-16. Tananarive, November, 1917.

Maize does very well at all altitudes in the island of Madagascar, where it is cultivated throughout the year. In certain dry districts, if the necessary water is supplied by irrigation, maize may be had in all its stages — a sight often seen in the well-irrigated valleys of the south-west. It is, however, chiefly grown along the western coast from November, when it is sown after the first rains, till March, when it is harvested. Two, or even three, harvests are possible all over the island, one being without irrigation. The province of Tuléar alone could produce 50,000 metric tons of grain exclusive of the amount necessary for local consumption.

Before the war it was not possible to grow maize for export in Madagascar, owing to the cost of transport to the large European ports, freight being quite prohibitive. As a result of the war, the production of maize has decreased in the belligerent countries and increased in those neutral countries which could grow it more largely; as the demand is in excess of the supply, there is scope for newcomers on the market. These facts, together with the increased prices and levelling of freight on all shipping lines, completely change the position of Madagascar and place it in the best possible conditions for supplying profitably at least all the maize imported by France, which, in normal times, reached the round figure of 500,000 metric tons, but which, at present, is being imported in much larger quantities. Emphasis is laid on the necessity of organisation among the farmers to carry out this scheme.

161 - **Transplanting in the Control of "Wild" Rice in Italy.** — MARCARELLI, B., in *Il Giornale di Riscoltura*, Year VII, No. 21, pp. 260-264. Vercelli, November 15, 1917.

In the Italian rice-fields the name "riso-crodo" or "riso selvatico" (wild rice) is given to plants forming sub-varieties, now become wild, of the oldest variety of rice cultivated. They are characterised by: — vigorous growth from the beginning; the ease with which the grain drops from the panicles with the slightest contact; the vitality of the grain lasting many years. They are placed in two principal categories: — 1) with white panicles; 2) with red panicles. The first category, which is the more common and more dangerous because of the ease with which the grain falls when ripe, includes plants of medium growth, with white nodes, rather compact large panicles with round, bearded grain of a silvery white after earing and during flowering, but yellowish when ripe. The plants of the second category are less dangerous, because less common with little tendency to remain wild; they are straight, high, with black nodes, slightly hulled or bare grain, long and covered with a yellowish-red down. Since a few years there has spread more extensively another sub-variety, similar to that of the second category in size, but with long-bearded, black panicles, whose grain falls very easily and spreads quickly.

It is impossible to exterminate these plants by uprooting ("rimonde"), because, while green, they resemble cultivated rice very closely, and, after earing, they are very similar to "Ostiglia" and "Lencino" rice. It is for this reason that they are the cause of serious loss in permanent rice fields, a loss exceeding that caused by the most common weeds, sometimes affecting 70 to 80 % of the yield. Moreover, the few grains which pass into the crop decrease its value, for they break easily during threshing and, after polishing, have reddish lines.

When a rice field infested with "wild" rice has been under rotation for one or two years with meadow grass or wheat, and the turn of rice comes round again, the "wild" rice appears again, stronger than ever, because a large number of grains remain alive in the soil.

The methods recommended for the control of "wild" rice are. — Turning poultry on to the rice field immediately after the harvest; burning the stubble whenever and wherever possible; deep winter and spring ploughing; careful and continuous weeding of the field; collecting the panicles immediately after flowering; sowing in lines so that all plants growing in the spaces may be pulled up.

Nevertheless, all these methods are not always efficient for fighting or preventing the spread of the plants; but they disappear easily and quickly if the transplantation method is adopted. By this method, between two harvests of rice, may be obtained one of colza, crimson clover, hay or rye. The "wild" rice seeds which have shot up during this intermediate harvest ripen with great difficulty on account of the insufficient winter-spring temperature. The basis of this method is as follows: as soon as transplantation has been carried out, the level of the water must be raised from 5 to 30 cm., thus the "wild" rice remains too long out of contact with the air and rots. The few plants which survive are soon outstripped and overcome by the cultivated rice, and rapidly turn yellow and die.

The life cycle of "wild" rice is much affected, and completely stopped after two or three years of the transplantation method, which is the only efficacious one for eradicating this weed from new rice fields, or old or mountain ones.

**STARCH CROPS** 162 - **Tuber and Root Cultivation Trials made in 1916 at the Agricultural Station of Flahult, Sweden.** — VON FEILITZEN, HJALMAR, in *Svenska Mosskulturförenings Tidskrift*, Year XXXI, No. 6, pp. 469-486. Jönköping, 1917.

1) **COMPARATIVE EXPERIMENTS WITH 35 VARIETIES OF POTATOES.** — An average yield of 6.36 tons per acre was obtained, with a maximum of 11.15 and 10.35 tons per acre for Grahns Non Plus Ultra and the English potato, The Factor, respectively. The percentage of small tubers was fairly high — 20.7 % — as a result of the early autumn frosts which prevented full growth. In comparison with the starch percentages of 1915 and 1914 (15.4 and 15.1 %), that of 1916 was low, an average of 13.15 %, with a maximum of 14.56 and 14.18 % respectively for Makalös and Non Plus Ultra. The starch yield per acre was 3 569 lbs. for Non Plus Ultra, 3 186 lbs. for Juvel, 3 093 lbs. for Harbinger, and 3 038 lbs. for The Factor.

2) **ROOT CROPS.** — Turnips lead with 27.87 tons per acre (Weibulls Bortfelder and Svalöf Bortfelder); then come kohlrabi, with 9.15 tons, mangolds (Ovoïde des Barres), with 8.55 tons, and, lastly, carrots (Champion), with 4.77 tons per acre.

**FORAGE CROPS** 163 - **The Cultivation of Alfalfa in the Oasis of Tripoli.** — MAZZOCCHI-ALEMANNI, NALLO, in *R. Ufficio agrario della Tripolitania, La coltivazione dell'erbamedica nell'oasi tripolina* (Istruzioni pratiche agli agricoltori locali), Istruzione No. 1, pp. 18. Italian text + 2 figs. + pp. 10. Arab text + 1 coloured plate. Tripoli, 1917.

Alfalfa is undoubtedly the most important native irrigated herbaceous crop of the Tripolitan oasis, often it is the only one, and, at any rate, is the principal fodder of the draught animals, who usually eat it green.

The high yields obtained from alfalfa locally, far surpassing those of the best Italian irrigated fields, the good quality of the fodder, its high price, the absence or lack of other foods for livestock, and the absolute necessity for the native farmer to have an animal employed permanently on a certain kind of work, especially drawing water from the wells, are all factors which prompt him to give as much attention as possible to this crop.

In normal times preference is given to alfalfa (native name: "sofsa") rather than barley, which is grown on the steppes round the oasis, or received from the interior. The production of seed for the market is very limited, and its price very high. In 1917 the Royal Agricultural Office started to distribute seed free of charge, and, to improve the crop, issued practical rules (given in the paper under review) drawn up from observations made in the best alfalfa fields of the district.

The soil of the Tripolitan oasis is very well suited to the growing of alfalfa so long as it is well cultivated (deep and careful hoeing, weeding) and manured with: — 398.25 cwt. of manure; 20 cwt. of wood ash; 3.98 to 4.76 cwt. of calcium sulphate; 3.18 cwt. of superphosphate per acre. After harrowing down the soil, a network of small irrigation canals is constructed according

to the excellent native system, which consists of a series of main canals (usually of earth, rarely of stonework), arranged like fish-bones, and a certain number of secondary canals, also of earth, distributed over the whole area to be irrigated. The ground between two of these secondary canals is divided into a double row of plots ("gedaue"; *gedula* in the singular) measuring from 2 to 6  $\frac{1}{2}$  square yards, flooded separately by the water from the small secondary canals, each of which feeds a double row of plots, usually losenge shaped. Its well to surround the alfalfa field by hedges so as to protect it against the winds.

Local seed must be used. Repeated experiments with Italian and Tunisian seed always gave very bad results. There are two strains of native alfalfa: — "chobbesi" and "nefeh". The first gives higher yields and has larger leaves; the second has smaller leaves and lower yields. The most famed oasis localities for the production of good seed are Tadjourah and Al Aïoun (Menschiah). The seed from the former is excellent in all soil which have soft water; those from the latter are particularly suited to soil irrigated with slightly brackish water. The best time for sowing is between March and May. Alfalfa is also sown from October to November at the same time as barley. It is sown either in lines, in holes containing 3 or 4 seeds, or broadcast. In the last case, sowing must be followed by hoeing, and always by abundant irrigation.

Ten to fifteen days are allowed to elapse between the first and second irrigation, so as to allow the roots to penetrate deeper. The normal duration of irrigation is from 5 to 6 days during the hot season, and from 10 to 12 days, or even more, during winter. A depth of from 30 to 50 mm. of water is given at each irrigation. Weeding is very important. Manure is not usually given during the first year, but the following years liquid manure is added to the irrigation water. The first cutting is made from 42 to 48 days after sowing; the others follow each other at intervals of from 20 to 25 days in summer, and from 30 to 40 days during the cool season. Good local alfalfa fields will give at least 8 cuttings a year, normally 10, and sometimes even 12. Experiments carried out by the author gave yields of 88  $\frac{1}{2}$  tons of grass per acre, equal to 22  $\frac{1}{4}$  tons of hay. In special cases higher yields may be obtained. As a rule alfalfa is not dried, but fed green. In normal times the truss gathered on one "gedula" has an average value of 4*d.*

The seed is collected only in the third year, which is usually the last. After alfalfa any crop may be grown except pepper.

DISEASES AND PESTS. — The only cryptogamic disease observed so far is leaf rust (*Uromyces striatus*), which, however, has never attacked the fields to such an extent as to compromise the crop or to make curative measures indispensable. As a protection against Aphids it is advisable to spread fine ash and irrigate less, or else cut before maturity. In 1916 the presence of *Cuscuta* was observed, and again in 1917. It seems to have been introduced into the oasis by the use of stable manure from the army, where hay from Italy is used.

164 - **An Annual Variety of *Melilotus alba*.** - COE, H. S., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 8, pp. 380-382. Washington, November 20, 1917.

This paper is a contribution from the Office of Forage-Crop Investigations, Bureau of Plant Industry, U. S. Department of Agriculture. *Melilotus alba* is a biennial plant. In the spring of 1916 *Melilotus* seed from various districts was sown at Redfield, S. Dakota and Fargo, N. Dakota. In these two districts, seed from Alabama gave about 5 % of plants which flowered and matured seed during the first year; these plants did not differ, in most respects, from the typical biennials, but they all died during the following winter. The principal difference between the plants which flowered the first year and the biennial plants lies in the root; that of the former is a typical taproot with no enlargement at the crown and no crown buds; that of the latter normally possesses these characters. On the 27th. January, 1917, 275 seeds of the annual plants were sown in pots in a greenhouse; plants were obtained which, by May 25th., measured 4.5 to 5.5 feet, and were in flower.

The white-flowered annual variety may very likely be found in other districts of the south of the United States than those mentioned. It would probably be of great economic value as a winter crop in the south of the Gulf States, and in the centre and south of the United States as a summer hay crop and for green manure.

The acreage under *M. alba* in the United States is rapidly increasing; the most serious objection is the difficulty of eradicating it by autumn ploughing. This difficulty may be overcome by using the annual variety.

165 - **The *Eragrostis* of the Argentine and Uruguay: Their Value as Fodder Plants.** - GIROLA, CARLOS D., in *Boletín del Ministerio de Agricultura de la Nación* (Extracto), pp. 20, figs 5. Buenos Aires, 1917.

This paper is a summary of the various works aiming at making known the species of *Eragrostis* in the Argentine and neighbouring countries, especially with respect to their fodder and agricultural value.

The following species are included in the herbarium of the Argentine Ministry of Agriculture, or described by various authors for the Argentine or for Uruguay: —

*Eragrostis airoides* — *atrovirens* — *bahiensis* — *brasiliiana* — *brasiliensis* — *calotheca* — *capillaris* — *ciliaris* — *diplachmoides* — *elegans* — *Eragrostis* — *expansa* — *flaccida* — *hypnoides* — *interrupta* — *lindmanni* — *longipila* — *lugens* — *major* — *megastachya* — *mexicana* — *microstachya* — *minor* — *Neesii* — *neomexicana* — *nigricans* — *orthoclada* — *pilosa* — *plana* — *poaeoides* — *polytricha* — *psammodes* — *purpurascens* — *refuscens* — *reptans* — *retinens* — *rosea* — *seminuda* — *striata* — *superba* — *triflora* — *tricholea* — *violae* — *verticillata* — *virescens*.

These species are found over a large area; the most common are *E. pilosa* and *E. lugens*, valuable fodder plants in ploughed land. They resist the most diverse climatic conditions, adapt themselves to all soils, but prefer clean ones, profit much from fertilisers, especially lime and phosphates, as was proved experimentally by the author. They are propagated by seed. As they do not grow very thickly they yield better when mixed

with other Gramineae and with Legumineae. The earliest are *E. lugens* and *E. pilosa*, followed by *E. major*, *E. poaeoides*, *E. mexicana* and *E. megastachya*; the others are less tender and, consequently, late. They are better suited to pasture than to hay, partly because they bear being grazed very well. The most tender, and, therefore, the most valued varieties, give an average yield of 2.58 tons of grass per acre, which is reduced to 0.79 tons of hay (some do not give half this yield); those which grow best yield from 2.78 to 3.18 tons of grass per acre, giving from 0.79 to 0.99 tons of hay.

Analyses made in the Laboratory of Agricultural Chemistry of the Ministry of Agriculture (Buenos Aires) gave the results shown in the appended table. The narrow food ratio of the Argentine *Eragrostis* hay, which shows them to be superior to natural meadow hay and ray grass hay, explains the preference cattle show for them.

*Analyses of Argentine Eragrostis Hays.*

	<i>E. major</i>	<i>E. pilosa</i>	Average for the two varieties	Average for the two varieties expressed as dry matter
Moisture (100-105° C.) . . . . .	16.08	17.34	16.71	—
Dry matter. . . . .	83.92	82.66	83.29	100
Ash . . . . .	11.92	9.46	10.69	12.83
Crude protein . . . . .	11.94	12.92	12.43	14.92
Total nitrogen . . . . .	1.91	2.07	1.99	—
Fats. . . . .	1.51	1.58	1.54	1.84
Carbohydrates. . . . .	36.60	34.66	35.63	42.77
Crude fibre. . . . .	21.94	24.02	22.98	27.59
Food ratio . . . . .	1:3	1:2.8	1:3	1:3

166 - Important Range Plants: Their Life History and Forage Value. — SAMPSON, ARTHUR, W., in *U. S. Department of Agriculture, Bulletin No. 545*, pp. 63 + LVI plates. Washington, October 8, 1917.

The Forest Service of the United States Department of Agriculture, in co-operation with the Bureau of Plant Industry, undertook, in 1907, in the Wallowa National Forest (north eastern Oregon) a study of the forage plants of grazing land in order to determine the habits, requirements and life history of the more important species. By observing bands of sheep while they grazed, the plants preferred by them were ascertained. The relative value of each variety was determined by studying its abundance, distribution, time of flowering, aggressiveness, reproduction (both vegetatively and by seed), seed habits, palatability, food value at various times during the grazing season and ability to withstand trampling.

Though the results are largely based on observations in the high mountains of Oregon at altitudes between 5 500 and 8 000 feet, they should be useful in revegetating the range throughout the West, since many of the species described are widely distributed, and the genera represented are among

*Moisture requirements of the species studied and the germinative power of their seed.*

Local name	Scientific Name	Soil-water content at time of excessive wilting	Class	germinating power of seed per cent
		%		%
High Huckleberry	<i>Vaccinium membranaceum</i>	—		—
Mountain Onion	<i>Allium validum</i>	14.0—16.0	A	37.0
Slender Reed Grass	<i>Cinna latifolia</i>	13.5—16.0		79.0—86.8
Tall Meadow Grass	<i>Panicularia nervata</i>	12.0—14.0		85.0
Tall Swamp Sedge	<i>Carex exsiccata</i>	22.5—24.0		15.2
Black Hair-grass	<i>Deschampsia atropurpurea</i>	12.5—14.7		—
False Hellebore	<i>Veratrum viride</i>	11.0—14.5		—
Fireweed	<i>Chamaenerion angustifolium</i>	8.2—11.5		16.5—28
Fire Willow	<i>Salix Scouleriana</i>	—		—
Porcupine Grass	<i>Stipa occidentalis</i>	9.5—11.5		27.0
Rush	<i>Juncus Mertensianus</i>	—	B	—
Rush	<i>Juncus orthophyllus</i>	—		—
Small Wild Onion	<i>Allium fibrillum</i>	—		—
Smooth Wild Rye	<i>Elymus glaucus</i>	7.5—9.8		21.2
Tufted Hairgrass	<i>Deschampsia caespitosa</i>	11.5—14.5		20.0—50.0
Wild Celery	<i>Ligusticum oreganum</i>	8.0—9.5		2.0—11.5
Wild Onion	<i>Allium platyphyllum</i>	—		—
Wood Rush	<i>Juncoides parviflorum</i>	10.0—12.5		7.5
Butterweed	<i>Senecio triangularis</i>	11.5—14.0		18.0—26.0
Coneflower	<i>Rudbeckia occidentalis</i>	16.0—18.5	A and B	11.0—24.5
Marsh Pine Grass	<i>Calamagrostis canadensis</i>	11.0—14.0		59.5—86.5
Mountain Timothy	<i>Phleum alpinum</i>	14.0		58.2—76.0
Sheep Sedge	<i>Carex illota</i>	14.0		27.5
Big Bunch Grass	<i>Agropyron spicatum</i>	5.5—7.5		26.2
Blue Bunch Grass	<i>Festuca idahoensis</i>	—		11.0—21.0
Elk Grass	<i>Carex Geyeri</i>	6.5		6.0—32.0
Geranium	<i>Geranium viscosissimum</i>	—		29.5
Horsemint	<i>Agastache urticifolia</i>	—		16.0—28.5
Little Bluegrass	<i>Poa Sandbergii</i>	6.5—7.8		7.0—38.4
Little Needle Grass	<i>Stipa minor</i>	9.2—11.5		—
Mountain Bunch Grass	<i>Festuca viridula</i>	7.0—9.5		12.2
Mountain Dandelion	<i>Agoseris glauca</i>	8.0—10.0		29.0—41.0
Mountain June Grass	<i>Koeleria cristata</i>	10.0—13.5		14.0—16.0
Mountain Wheat Grass	<i>Agropyron violaceum</i>	6.0—7.5	C	85.5
Onion Grass	<i>Melica bella</i>	6.3—8.5		4.0
Pine Grass	<i>Calamagrostis Suksdorfii</i>	5.5—8.5		69.5
Red Bunch Grass	<i>Agropyron flexuosum</i>	—		—
Rush	<i>Juncus confusus</i>	—		—
Rush	<i>Juncus Parryi</i>	5.5—7.0		—
Salt Cheat	<i>Bromus hordeaceus</i>	5.5		63.3
Spiked Trisetum	<i>Trisetum spicatum</i>	7.5—9.5		19.5
Short-awned Bromegrass	<i>Bromus marginatus</i>	5.5—8.0		38.0—58.0
Tall Bluegrass	<i>Poa brachyglossa</i>	—		—
White Foxtail	<i>Stantonium velutinum</i>	6.0—8.5		43.0—82.5
Woolly Weed	<i>Heracium cynoglossoides</i>	8.0—10.5		9.3—12.5
Yarrow	<i>Achillea lanulosa</i>	10.0—12.3		16.5—90.0
Alpine Redtop	<i>Agrostis Rossae</i>	7.0—8.5		29.0—41.0
Blue Beard tongue	<i>Penstemon procerus</i>	8.0—10.0	B	18.5
Skunkweed	<i>Polemonium pulcherrimum</i>	7.0—10.0	and C	32.5—41.5
Slender Hairgrass	<i>Deschampsia elongata</i>	8.5—15.0		41.5—56.5
Wild Black-wheat	<i>Polygonum phytolaccasfolium</i>	8.0—10.0		3.0—13.5
Black-wheat	<i>Valeriana stichensis</i>	7.0—8.5		21.5—26.00



the most important of those of the Western ranges. The bulletin gives a description and a natural size photograph of each important species.

The appended Table gives the relative water requirements of the most important plants studied. The relative ability of the various species to withstand drought was ascertained by determining the amount of water remaining in the soil when the plant had wilted to a point from which it could not recover. For artificial determinations the plants were dug up, with the roots undisturbed in their own soil, particular care being taken to prune off as little of the root system as possible. The lump of soil was placed in a wire basket and put back into the hole made by digging up the plant. After the plant had regained its strength it was slightly raised in order to increase the rapidity of the drying process. For plants with deeply penetrating roots especially, the soil was sometimes dug away all round the plant, leaving in place only the central core of soil; when the plant had wilted completely the moisture was determined by taking two samples of the soil.

In order to compare habitat requirements, the species are grouped in three classes.

CLASS A. — Plants of high moisture requirements, living in saturated soil, such as open marshes, wet meadows and bogs.

CLASS B. — Plants of medium moisture requirement, in relatively heavy soils which are saturated during the early part of the season, but later contain a medium amount of water.

CLASS C. — Plants of low moisture requirement, in well-drained lands, open glades, and exposed situations.

The table shows about  $\frac{3}{4}$  ths. of the most valuable forage crops to be dry-land plants. The vegetation of wet lands is very luxuriant, but little appreciated by live stock and of low food value.

The data on the germinating capacity of the seeds (see Table) were obtained from the seed-testing laboratory of the United States Department of Agriculture.

In another table are given the time of flowering and that of the ripening to the seeds of 51 species for 3 consecutive years (1907, 1908, 1909). They show that the flowering period varies more than that of seed maturity. All species and conditions considered, the flower stalks are mainly produced between July 5th. and August 10th., and the seed matures between August 15th. and September 1st. These periods are influenced by physical factors, but far more so by the weakening of the vegetation due to overgrazing. The periods of flowering and ripening are thus retarded, and, in extreme cases, no flower stalks are produced, and the seed has little or no germinative power.

167 — **Composition and Improvement of the South-Western Ranges of the United States.** — See No. 188 of this *Review*.

168 — **Influence of the Time of Cutting on the Amount and Composition of the Hay Produced.** — See No 184 of this *Review*.

*Moisture requirements of the species studied and the germinative power of their seed.*

Local name	Scientific Name	Soil-water content at time of excessive wilting	Class	germinating power of seed per cent
		%		%
High Huckleberry	<i>Vaccinium membranaceum</i>	—		—
Mountain Onion	<i>Allium validum</i>	14.0—16.0	A	37.0
Slender Reed Grass	<i>Cinna latifolia</i>	13.5—16.0		79.0—86.8
Tall Meadow Grass	<i>Panicularia nervata</i>	12.0—14.0		85.0
Tall Swamp Sedge	<i>Carex exsiccata</i>	22.5—24.0		15.2
Black Hair-grass	<i>Deschampsia atropurpurea</i>	12.5—14.7		—
False Hellebore	<i>Veratrum viride</i>	11.0—14.5		—
Fireweed	<i>Chamaenerion angustifolium</i>	8.2—11.5		16.5—28
Pire Willow	<i>Salix Scouleriana</i>	—		—
Porcupine Grass	<i>Stipa occidentalis</i>	9.5—11.5	B	27.0
Rush	<i>Juncus Mertensianus</i>	—		—
Rush	<i>Juncus orthophyllus</i>	—		—
Small Wild Onion	<i>Allium fibrillum</i>	—		—
Smooth Wild Rye	<i>Elymus glaucus</i>	7.5—9.8		21.2
Tufted Hairgrass	<i>Deschampsia caespitosa</i>	11.5—14.5		20.0—50.0
Wild Celery	<i>Ligusticum oreganum</i>	8.0—9.5		2.0—11.5
Wild Onion	<i>Allium platyphyllum</i>	—		—
Wood Rush	<i>Juncoides parviflorum</i>	10.0—12.5		7.5
Butterweed	<i>Senecio triangularis</i>	11.5—14.0	A and B	18.0—26.0
Coneflower	<i>Rudbeckia occidentalis</i>	16.0—18.5		11.0—24.5
Marsh Pine Grass	<i>Calamagrostis canadensis</i>	11.0—14.0		59.5—86.5
Mountain Timothy	<i>Phleum alpinum</i>	14.0		58.2—76.0
Sheep Sedge	<i>Carex illota</i>	14.0		27.5
Big Bunch Grass	<i>Agropyron spicatum</i>	5.5—7.5		26.2
Blue Bunch Grass	<i>Festuca idahoensis</i>	—		11.0—21.0
Elk Grass	<i>Carex Geyeri</i>	6.5		6.0—32.0
Geranium	<i>Geranium viscosissimum</i>	—		29.5
Horsemint	<i>Agastache urticifolia</i>	—		16.0—28.5
Little Bluegrass	<i>Poa Sandbergii</i>	6.5—7.8		7.0—38.4
Little Needle Grass	<i>Stipa minor</i>	9.2—11.5		—
Mountain Bunch Grass	<i>Festuca viridula</i>	7.0—9.5		12.2
Mountain Dandelion	<i>Agoseris glauca</i>	8.0—10.0		29.0—41.0
Mountain June Grass	<i>Koeleria cristata</i>	10.0—13.5		14.0—16.0
Mountain Wheat Grass	<i>Agropyron violaceum</i>	6.0—7.5	C	85.5
Onion Grass	<i>Melica bella</i>	6.3—8.5		4.0
Pine Grass	<i>Calamagrostis Suksdorfii</i>	5.5—8.5		69.5
Red Bunch Grass	<i>Agropyron flaxuosum</i>	—		—
Rush	<i>Juncus confusus</i>	—		—
Rush	<i>Juncus Parryi</i>	5.5—7.0		—
Soft Cheat	<i>Bromus hordeaceus</i>	5.5		63.3
Spiked Trisetum	<i>Trisetum spicatum</i>	7.5—9.5		19.5
Short-awned Bromegrass	<i>Bromus marginatus</i>	5.5—8.0		38.0—58.0
Tall Bluegrass	<i>Poa brachyglossa</i>	—		—
White Foxtail	<i>Sitanion velutinum</i>	6.0—8.5		43.0—82.5
Woolly Weed	<i>Heracium cynoglossoides</i>	8.0—10.5		9.3—12.5
Yarrow	<i>Achillea lanulosa</i>	10.0—12.3		16.5—90.0
Alpine Redtop	<i>Agrostis Rossae</i>	7.0—8.5		29.0—41.0
Blue Beard tongue	<i>Penstemon procerus</i>	8.0—10.0	B and C	18.5
Skunkweed	<i>Polemonium pulcherrimum</i>	7.0—10.0		32.5—41.5
Slender Hairgrass	<i>Deschampsia elongata</i>	8.5—15.0		41.5—56.5
Wild Buckwheat	<i>Polygonum phytolaccasfolium</i>	8.0—10.0		3.0—13.5
Valerian	<i>Valeriana sitchensis</i>	7.0—8.5		21.5—26.00

the most important of those of the Western ranges. The bulletin gives a description and a natural size photograph of each important species.

The appended Table gives the relative water requirements of the most important plants studied. The relative ability of the various species to withstand drought was ascertained by determining the amount of water remaining in the soil when the plant had wilted to a point from which it could not recover. For artificial determinations the plants were dug up, with the roots undisturbed in their own soil, particular care being taken to prune off as little of the root system as possible. The lump of soil was placed in a wire basket and put back into the hole made by digging up the plant. After the plant had regained its strength it was slightly raised in order to increase the rapidity of the drying process. For plants with deeply penetrating roots especially, the soil was sometimes dug away all round the plant, leaving in place only the central core of soil; when the plant had wilted completely the moisture was determined by taking two samples of the soil.

In order to compare habitat requirements, the species are grouped in three classes.

**CLASS A.** — Plants of high moisture requirements, living in saturated soil, such as open marshes, wet meadows and bogs.

**CLASS B.** — Plants of medium moisture requirement, in relatively heavy soils which are saturated during the early part of the season, but later contain a medium amount of water.

**CLASS C.** — Plants of low moisture requirement, in well-drained lands, open glades, and exposed situations.

The table shows about  $\frac{3}{4}$  ths. of the most valuable forage crops to be dry-land plants. The vegetation of wet lands is very luxuriant, but little appreciated by live stock and of low food value.

The data on the germinating capacity of the seeds (see Table) were obtained from the seed-testing laboratory of the United States Department of Agriculture.

In another table are given the time of flowering and that of the ripening to the seeds of 51 species for 3 consecutive years (1907, 1908, 1909). They show that the flowering period varies more than that of seed maturity. All species and conditions considered, the flower stalks are mainly produced between July 5th. and August 10th., and the seed matures between August 15th. and September 1st. These periods are influenced by physical factors, but far more so by the weakening of the vegetation due to overgrazing. The periods of flowering and ripening are thus retarded, and, in extreme cases, no flower stalks are produced, and the seed has little or no germinative power.

**167 — Composition and Improvement of the South-Western Ranges of the United States.** — See No. 188 of this *Review*.

**168 — Influence of the Time of Cutting on the Amount and Composition of the Hay Produced.** — See No 184 of this *Review*.

## FIBRE CROPS

169 - "Bate's Big Boll", an American Variety of Cotton Tested in Sicily. — PRESTIANNI, NUNZIO, in *Il Coltivatore*, Year I, XII, No. 30, pp. 271-273. Casale Monferato, October 30, 1917.

This paper gives the results of experiments carried out in Sicily since 1911 to find a variety well suited to the climate of the country and capable of yielding a product more abundant and of higher quality than that of "cotone nostrale" (local cotton-plant), cultivated since remote times in the districts of Sciacca, Menfi and Ribera (Sicily).

Among the varieties tested, an American one, *Bate's Big Boll*, proved valuable and steps are being taken to increase its cultivation. In 1915 the production of staple in the district was 1.968 tons, in 1916, 3.936, and in 1917 it must have been 9.84 tons.

The characteristics of the variety are:

A vigorous, pyramid-shaped, bushy plant, with strong, dark red branches; in fresh, deep soil it reaches a height of from 23  $\frac{1}{2}$  to 29  $\frac{1}{2}$  inches, and, on the average, in clay (non-irrigated) soils, a height of from 15  $\frac{3}{4}$  to 19  $\frac{1}{2}$  inches. The leaves are rather large, of a deep green colour, with, at the most, 3 oval acuminate lobes. The flowers are large and pink. The capsules are large, oval and round, with 4 to 5 cells and 32 to 34 tufts of staple. Ripening begins at the end of August and continues throughout October.

The average yield of unginned cotton in non-irrigated soils is from 6.16 to 7.16 cwt. per acre, the average yield of staple, from 38 to 39 % (33 % at the most for local cotton).

The staple is fairly strongly attached to the seed, of a creamish-white, not very lustrous, soft, of an average length of 27 to 29 mm., of average resistance, homogenous. Its commercial value is much above that of the local plants.

170 - The *Allanthus* (*Allanthus glandulosa*) as a Paper-Yielding Plant. — FEDELE, V., in *La Nuova Agricoltura del Lazio*, Year V, No. 118, p. 345. Rome, December 1, 1917.

Some years ago (cf. *Il Coltivatore*, No. 4, Jan. 24, 1909) the author, as a result of experiments he made, mentioned the ailanthus as an excellent paper-yielding plant. It has the advantage of growing well everywhere, even in arid or purely rocky soils. By pollarding every three years and keeping the crown about 3  $\frac{1}{4}$  to 4  $\frac{1}{4}$  feet above the ground the author obtained about 200 lbs. of wood, which yielded 44 % of an easily bleached cellulose of a quality suitable for paper pulp. In 1909, the author estimated the value of this cellulose at 8*d.* per quintal of wet material; at the present day that value has increased greatly. One acre may contain from 240 to 280 trees, which, under normal market conditions, would give a profit of £ 8 per acre every three years.

PLANTS  
YIELDING OILS

171 - *Plukenetia conophora* ("Ngart"), a New Oil Plant of the Cameroons. — See No. 138 of this *Review*.

172 - **The Importance of Sweet Sorghum.** — PIÉDALLU, ANDRÉ, in *Comptes rendus des Séances de l'Académie d'Agriculture*, Vol. III, No. 38, pp. 1091-1095. Paris, December 5, 1917.

The author, after having shown how old is the cultivation of sweet sorghum (*Sorghum vulgare* Pers., var. *saccharatum*), describes his experiments with this plant, which he has grown near Paris, and which has done well there, partly ripening its grain. When replanting the young plants he observed that the stems could be made to multiply by embedding or hilling up the seedlings. By this method he was able to obtain strong plants with 4 or 5 stems instead of one, each of which produced a panicle and, in August, reached a height of 6 feet, some even exceeding 8 feet.

The uses to which all the different parts of the plant may be put are described.

**STEMS.** — In the climate of Paris the sugar content is only 4 to 5 % of saccharose, without reducing sugars. According to the author, the uncrystallisable reducing sugars of sweet sorghum are derived from the fermentation of the stems before treatment. In southern countries the sugar content is from 10 to 15 % (1), with 2 to 4 % of reducing sugars. Some vine-growers of the south cultivate a small quantity of sweet sorghum to strengthen the alcohol content of the wine.

**STEM RESIDUES.** — With the abundant fibre of the plant the author succeeded in producing a good paper. Analysis showed the stem to contain 15 to 17 % of fibre, or 29 440 lbs. of stripped stems gave 2 metric tons of paper pulp per acre.

**LEAVES.** — A good food for rabbits, which the author fed on them, although poisoning of livestock has been reported from Egypt and the Indies caused by young or badly developed leaves containing a cyanogenic glucoside, dhurrine (2).

**ROOTS.** — May be used for making alcohol.

**GRAIN.** — The author obtained about 100 gm. of grain per plant. In the south this yield may be 200 to 300 gm.; 100 gm. of grain give 72 gm. of hulled grain and 28 gm. of glumes.

The grain, which has a large reserve of starch, nitrogen and fat, gives a brown flour with a good flavour which may be mixed with wheat flour for breadmaking (3). It may be used for feeding livestock.

**GLUMES.** — The author extracted a colouring matter, which he is studying. It is characterised by an orange-red colour in dilute solutions of strong acids, changing to violet with alkalis. A drop of this acid solution, added to water containing lime salts, gives a characteristic violet-pink lake. This colouring matter dyes wool and cotton grey with iron, violetgrey with copper, pinkish-violet with aluminium, more or less dark brown with alkaline bichromate. It also dyes leather.

(1) AIMÉ, *Revue de l'Intendance*, Vol. XX, 1907; RIVIÈRE and LECQ, *Manuel pratique de l'Agriculture en Algérie*. (Author). — (2) JUMELLE, *Cultures coloniales*; BARRAL and SAGNIER, *Dictionnaire de l'Agriculture* (Author). — (3) See B. 1915, No. 742. (Ed.)

173 - **Relation of the Transformation and Distribution of Soil Nitrogen to the Nutrition of Citrus Plants.** — MC BETH, J. G. (Physiologist, Soil Bacteriology and Plant Nutrition Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in *Journal of Agricultural Research*, Vol. IX, No. 7, pp. 183-252, 19 figs, XXX tables, bibliography of 14 publications. Washington, D. C., May 14, 1917.

The total nitrogen content of Californian Citrus lands is often low, and the quantity rendered assimilable through the natural processes of nitrification soon becomes inadequate to the needs of the plants unless it is maintained by the addition of commercial fertilisers, cover crops, manure, etc. On the other hand, the low rainfall of the districts in which citrus is grown, and the furrow system of irrigation practised, cause an uneven distribution of the nitrates in the soil, so that the solution of the nitrogen problem depends, not only on a knowledge of the factors influencing nitrification, but also on a knowledge of the forces controlling the distribution of nitrogen in the soil.

In order to solve these problems the author carried out at the Citrus Experiment Station grove at Riverside, Cal. a series of fertiliser and irrigation experiments with various quantities of ammoniacal and nitric nitrogen. He came to the following conclusions: —

A) FERTILISER. — 1) *Dried blood*. — Semi-arid soils often fail to nitrify dried blood when added in 1 % quantities, but invariably nitrify it when it is applied in quantities not exceeding those used ordinarily under field conditions. In the first case it often produces large accumulations of ammonia which do not occur in the second. Semi-arid soils to which has been added 1 % of dried blood may lose, during a six weeks' incubation period, 50 % of the nitrogen added. As they frequently give off a strong ammoniacal smell, this loss is probably largely due to the volatilisation of the ammonia. Ammonification or nitrification studies on semiarid soils to which 1 % of dried blood is added are of doubtful value, and may lead to erroneous conclusions.

2) *Green manures*. — These, especially the legume varieties, nitrify very rapidly; half of the nitrogen contained in the green plant tissues may be converted into nitrates in 30 days. They also form a valuable source of energy for the non-symbiotic nitrogen-fixing organisms.

B) IRRIGATION. — 1) The furrow system of irrigation often causes a very unsatisfactory distribution of the soil nitrates. In many Citrus groves more than  $\frac{2}{3}$  rds. of the nitric nitrogen in the top 4 feet of soil are found in the surface 6 inches, in which, owing to the frequent cultivation, few feeding roots are found. This system also frequently causes the formation of nitre spots (1), where, if the soil is heavily fertilised, as much as 1 % of nitrogen as nitrates may be found by surface scrapings. These spots, or salt crusts, attributed by HILGARD to rapid nitrification of the organic matter of the soil, by HEADDEN to the fixation of atmospheric nitrogen by nonsymbiotic bacteria, and by STEWART and PETERSON to the leaching of nitrates already in the soil, are, according to the author, rather to be attributed to the movement of water in the soil. Their characteristic brown colour depends on

(1) On the subject of nitre spots, see No. 129 of this *Review*. (Ed.)

many factors, of which the most important appears to be the deliquescent character of the calcium nitrate.

When the furrow system of irrigation is used the fertiliser should be ploughed down somewhat deeper than the land is cultivated, thus placing the food within reach of the feeding roots, because in the cultivated zone, the irrigation tends to carry it away from these roots.

Much nitric nitrogen is lost from citrus lands by leaching. The most effective way of preventing this loss is by growing a winter cover crop.

2) Basin irrigation or overhead irrigation give a more satisfactory distribution of soil nitrates than the furrow system. The first seems to give better results when combined with a mulching system. However, the rapidity with which materials rich in nitrogen decay would seem to make it inadvisable to maintain a constant mulch with these materials, as the nitrates produced would probably be much in excess of the needs of the tree, and much loss would result.

C) **MOTTLED LEAF** (1). — This disease is usually more marked in plots treated with large applications of commercial nitrogenous fertilisers, and is frequently (but not always) associated with a high nitric nitrogen content of the surface soil, a content which may be due to unfavourable conditions of the soil. An extremely variable supply of plant food and soil moisture may be an important factor in mottling. Mottled leaves usually have a higher moisture and nitrogen content than healthy leaves.

174.—**The Teak Trade of Siam.** — HANSEN, C. C., in *Commerce Reports*, No. 93, p. 275. Washington, D. C., 1917.<sup>1</sup>

FORESTRY

The teak forests of Siam are mainly located on the hillsides in the northern part of the Kingdom, some 500 miles from Bangkok. The teak trees are girdled and allowed to stand for several years before being felled, and the logs are then dragged to the nearest stream and floated down, reaching the sawmills at Bangkok, fully seasoned, in about 5 years from the time of girdling.

Teak logging is regulated by the Government, and only trees of 76.5 inches girth may be girdled. A Government counting station is located at Paknampoh, a village situated on the River Chao Phya, 155 miles from Bangkok. The average number of teak logs arriving at this station each year is estimated at 100 000, and in addition about 20 000 logs, cut from the forest region adjoining Burma, are floated to Moulmién.

The total annual output of cut teak of all grades amounts to roughly 55 000 loads of 50 cubic feet, but of first quality the yearly output would likely reach only about half of the above estimate. On reaching the sawmills the logs are usually squared and the first-quality squares are graded according to the British Admiralty specifications, and are designated "Europe first class".

Siam's total exports of cut teak of all sorts for the fiscal year ended March 31, 1916, and for the preceding year consisted of: —

(1) See R. 1916, No. 1225. (Ed.)

Cut Teak	1914-15		1915-16	
	Tons	Value	Tons	Value
Squares	34 422	\$ 1 338 535	30 980	\$ 1 124 195
Planks.	2 810	191 080	3 960	231 755
Shingles	345	12 550	238	8 130
Log and butt ends	857	24 175	1 051	36 620
Scantlings	7 247	249 240	10 313	368 145
Other	1 237	50 870	1 328	48 545
Total	46 918	\$ 1 866 450	47 870	\$ 1 817 390

Of the exports during 1915-16, most of the teak squares went to India, Hongkong took nearly half of the teak planks, the teak shingles went to Mauritius and Ceylon, most of the log and butt ends went to Hongkong, while scantlings were bought chiefly by India.

### LIVE STOCK AND BREEDING.

#### HYGIENE

175 - **Reaction Produced by the Intra-Palpebral Injection of Mallein.** — LANFRANCHI, A., in *Il Moderno Zootatro*, Series V, Year VI, No. 9, pp. 197-202, fig. 1. Bologna, September 30, 1917.

The diagnosis of glanders by means of the reaction produced by the intrapalpebral injection, proposed by the author in 1914, has been widely used, having been officially adopted for use in the Allied armies. As the author has applied it to a considerable number of cases, he has been able to make many observations, which have lead him to the conclusions given below.

If, on account of numerous reactions produced by intra-palpebral injections or for other causes, sclerosis of the conjunctive tissue is observed in the lower eyelids, the mallein should be injected into the upper eyelid.

In the case of a negative intrapalpebral reaction in subjects already tested several times by this method, and for which the period of the last intrapalpebral reaction is unknown, a minimum period of 15 days should be allowed to pass before repeating the injection. If this precaution is not taken, a subject still infected with the living organism may be thought to be free from glanders.

176 - **The Intra-Palpebral Reaction in the Diagnosis of Epizootic Lymphangitis** (1). — LANFRANCHI, A., in *Il Moderno Zootatro*, Series V, year VI, No. 10, pp. 217-225, fig. 5. Bologna, Oct. 31, 1917.

The clinical diagnosis of epizootic lymphangitis, although generally fairly easy, is, however, not always possible, and under practical conditions the microscope is not always available for identifying the characteristic RIVOLTA cryptococcus. For this reason, the writer has sought a sure method for diagnosing this infection, based on the so-called "allergic" local reaction, i. e., on a special state of specific hypersensibility of the affected subjects.

(1) See R. June, 1917, No. 561 and August, No. 731. (Ed.)



The test materials are prepared in the following manner:— to 1 part of pus, collected aseptically and known to be free from other microorganisms, 2 parts of ether are added; shake well, then leave to stand for 24 hours; the ether is then evaporated off on the water-bath; make up to the original volume with distilled water and leave to stand for 24 hours; then heat at 80° C on the water bath for 15 to 20 minutes and allow to cool; centrifuge for 20 to 30 minutes at 2000 to 3000 revolutions per minute; decant off the liquid part, which constitutes the vaccine to be used for inoculating in 2.5 to 3 cc. doses, according to the number of cryptococci in the pus used.

The injection into the eyelid is carried out in the usual way.

In healthy animals, or those infected with a disease other than epizootic lymphangitis, the injection gives rise to an oedema localised at the points of injection, or which at the most extends to the lower eyelid only. This oedema is produced in 1 or 2 hours after inoculation, attains its maximum between the 8th. and 10th. hours, then being slowly reabsorbed, and disappearing entirely after 20-24 hours. On the other hand, in animals infected with epizootic lymphangitis, the local reaction, which commences 2 to 4 hours after the injection, already extends, between the 4th. and 6th. hour, over all the lower eyelid, sensibly reducing the palpebral opening; the oedema spreads gradually and, after 24 to 48 hours, reaches the lower border of the zygomatic crest, passes it a little in front whilst progressing backwards towards the lower mandibular arch, which it may even reach. This local reaction lasts several hours, then slowly diminishes up to the 3rd., 4th. or 5th. day. The purulent conjunctivitis occurs 4 hours after inoculation and increases in 24-48 hours.

One test for the intra-palpebral reaction has no influence on successive tests. The most intense and lasting effects of the reaction are shown by animals in which lesions have already commenced.

The use of this method of diagnosis, combined with treatment by arsivan, which was tested by FAVERO (*Moderno Zootiatro*, Scientific Part, 1917, No. 6, p. 129), who suggested its use, would, thinks the author, cause the disappearance of the centres of infection from which the disease spreads.

**177 - The Treatment of Epizootic Lymphangitis (1) by Means of the Autolysed Extract of Yeast.** — NICOLLE, M., FAYET and TRUCHE, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 27, pp. 1114-1115. Paris, December 31, 1917.

To fight against epizootic lymphangitis, caused by the cryptococcus discovered by RIVOLTA in 1873, an organism very close to the yeasts, the authors have tried *group antigenotherapy*. In beer yeast, they have found a cheap and efficacious therapeutic agent. Used unchanged, after the action of alcohol-ether, it remains without effect and causes abscesses, caused by the great resistance of the cell walls. Used as an autolysed extract, which the authors propose to call "*rivoltine*", it is quite successful, causing no ill effects. In this way is given a mixture of antigens, some of which are evidently identical with these of the cryptococcus.

(1) See *R.*, August, 1917, No. 734, (Ed.)

To prepare the juice, pressed yeast is autolysed for 24 hours at 37° C. in chloroform vapour; it is then centrifuged the supernatant liquor filtered off, phenol added; the liquid is then sealed up in small phials.

After describing the excellent results of their experiments, the authors advise the following technique:

At first inject 2 cc. (under the skin of the neck) to test the sensibility of the subject; after 4 to 8 days increase the dose to 5 cc., according to the case; after another 8 days, give 10 cc.; it may be advisable to give one two subsequent injections of 10 cc.

At present, the authors are considering how to deal with possible failures and how to decrease the length of the treatment.

178 - **Leucocytotherapy; or Aseptic Pyotherapy; Its Use in Certain Cases of Equine Lymphangitis.** — BRIDÉE, J., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 27, pp. 1121-1123. Paris, December 31, 1917.

Two authors, MM. BELIN and VELU, have, independently of one another, carried out successful experiments on the use of pyotherapy in the treatment of epizootic lymphangitis of the horse; pus obtained from the lymphangitic lesions is diluted in ether, then in water physiologically phenolated; the diluted pus is injected under the skin or in the jugular vein of the diseased horses, at intervals of a few days and at doses varying between 2 to 6 cc., corresponding to 0.2 to 0.6 cc. of initial pus.

These authors believe that the action of the pyotherapy is due to specific organisms contained in the pus: to the cryptococci. They consider the dilution of the pus as a "pyovaccine", and the method of treatment as "vaccinotherapy" derived from the WRIGHT method.

However, M. VELU has shown recently that the pyovaccine has not a strictly specific action and that it is efficacious in affections having no connection with epizootic lymphangitis (fistulae, various suppurations), and M. BELIN has successfully employed the method against ulcerous lymphangitis by using the pus produced by that affection; yet, in ulcerous lymphangitis, the pus often contains a very limited number of microorganisms.

These two facts attracted the author's attention and he asked whether the efficacious action of the pus was due, not to the specific organisms they contained, but rather to the leucocytes and remains of leucocytes that they contained; whether, in other words, the same satisfactory results could not be obtained by injecting absolutely aseptic pus, like that of "fixation abscesses".

Experiments on this subject were carried out by treating horses suffering from ulcerous or epizootic lymphangitis with aseptic pus obtained by injecting oil of turpentine under the skin of the horse's thorax, and removing, after 4 or 5 days, pus from the abscess thus caused and mixing it with water physiologically phenolated.

The author has obtained, by injecting aseptic pus, results quite comparable with those published by MM. BELIN and VELU. He concludes that pyotherapy cannot be included under "vaccinotherapy" and that its action is due to the leucocytes of the pus and their products.

"Aseptic pyotherapy" might be employed to advantage in equine lymphangitis and in affections where pyovaccines have already proved useful. It may be that it will find a much wider application.

179 - **The Poisoning of a Horse Caused by Eating *Paspalum distichum* Parasitised by *Ustilagopsis deliquescens*.** — HUE, ENRIQUE, in the *Anales de la Sociedad rural Argentina*, Year I, II, Vol. XXXI, pp. 602-603. Buenos Ayres, October, 1917.

It has been known for some years that *Paspalum* (1) is poisonous to animals; thus, MEUZE (*Handbuch der Tropenkrankheiten*, 1913) showed that the bitter variety of *P. scrobiculatum* is poisonous. In the Argentine, similar constations have been made by: RIVAS and ZANOLLI (*La tembladera*, IV Congreso Científico celebrado en Santiago de Chile, 1909); QUEVEDO (*La enfermedad de los rastrojos*, *Revista zootecnica*, No. 28, 1911; *Paraplegia enzoótica de los ovinos* (2), *Ibid.*, No. 33, 1912; *La pataleta*, *Ibid.*, No. 37, 1912; *Estudio de un Aspergillus patógeno*; *Agronomía*, No. 8-9, 1912; *Paraplegia enzoótica de origen digestivo*, *Boletín del Ministerio de Agricultura*, Vol. XVII, No. 6, 1914; *Notas sobre una nueva enfermedad de los equinos*, *Gaceta rural*, 1914; etc.); QUEVEDO and LIGNIÈRES (*Enfermedad tetaniforme epizootica de los bovinos*, *Boletín del Ministerio de Agricultura*, 1913); MOSCONI (*Paraplegia de los equinos*, *Revista zootecnica*, No. 34, 1912); ACOSTA (*El Huecú*, Thesis, Buenos Ayres, 1914).

The author found that 2 kg. of dry *Paspalum distichum* strongly parasitised by *Ustilagopsis deliquescens*, when given to a horse, caused paraplegia after 2 days, paralysis and death after the 3rd. day. A post-mortem examination showed the cause was poisoning. Another horse, given 10.6 kg. of *P. distichum* slightly parasitised, collected near Buenos Ayres, showed no morbid symptom whatever.

In intravenous injections in the pigeon, a 10 % decoction of the excrescences produced on the host plant of *Ustilagopsis deliquescens* in a 5 cc. dose, and a 10 % maceration in a 2 cc. dose, proved quite harmless.

180 - **Study of *Bacterium Pullorum* Infection.** — PAGE, J. B., in the *Twenty-ninth Annual Report of the Massachusetts Agricultural Experiment Station. Public Document* No. 31, pp. 89a-91a. Boston, 1917.

During the years 1916 and 1917 the studies on bacillary white diarrhoea of pullets have been carried out at the Massachusetts Experiment Station along the lines established. The object of the work has been to improve methods in diagnosis, to explain reasons for symptoms in certain avian diseases at present but little understood and to aid in formulating methods for prevention and control.

The work was divided in three parts:

1) Specificity of *B. pullorum* antibodies, with special reference to the agglutinins.

2) Toxins elaborated by *B. pullorum* and their relation to specific conditions in adult birds.

(1) See R., 1917, Nos. 829, 924, 1179. — (2) See R. Nov. 1917, No. 1035. (Ed.).

3) Investigations concerning the production of antibodies, with special reference to potency and rate of production.

I. — The work concerning the specificity of *Bacterium pullorum* agglutinins has been continued since 1915, as have tests and procedures concerning the use of 25 strains of this organism isolated from birds in the State of Massachusetts. Recently, more than 10 new strains have been added to this list. The data obtained and that being accumulated will relate to thorough tests of the agglutinins elaborated by animals and birds against *B. pullorum*, particularly with cultures of the *B. coli*, *B. typhi*, *B. dysenteriae* group. At the present time 21 adult birds are immunized against *B. pullorum* and are producing definite agglutinins. Fourteen rabbits also are used for these studies, having been immunized and hyperimmunized during the past year.

II. — Up to the present a toxin which is suitable for carrying on progressive work has not been found. Definite studies, however, are under way toward this end. The results up to date show beyond a doubt that the toxin is endotoxic and also that it is most intimately connected with the bacterial cell. It is hoped that these studies will lead to an explanation of its action in relation to some of the paralytic conditions in adult birds, which in the last few years have been so common in the State of Massachusetts.

III. — The investigation concerning the production of antibodies, with special reference to the potency and rate of production, was started in August 1916, and agglutinins artificially produced. Blood from this stock has been studied, and now attempts are being made to study the progeny this year to determine the potency of agglutinins elaborated in birds descended from stock known to have definite infection experimentally produced. These studies are to be continued, with the hope that they will show the rate of production, and demonstrate why young pullet blood testing has not given as universally satisfactory results as the blood testing of birds that have laid eggs and have ovaries capable of complete function. This problem has direct bearing on the routine work of testing breeding flocks for indications of *Bacterium pullorum* infection.

ANATOMY  
AND  
PHYSIOLOGY:  
GENERALITIES

181 — Studies on the Duration of Life: Temperature Coefficients and Influencing Factors. — I. OSTERHOUT, W. J. V., Some Aspects of the Temperature Coefficients of Life Processes, in the *Journal of Biological Chemistry*, Vol. XXXII, No. 1, pp. 23-27, 1 fig., 2 tables. Baltimore, October, 1917. — II. LOEB, J. and NORTHRUP, J. H., On the Influence of Food and Temperature upon the Duration of Life. *Ibid.*, pp. 103-121, 6 fig., 13 tables. — III. NORTHRUP, J. H., The Effect of Prolongation of the Period of Growth on the Total Duration of Life, *Ibid.*, pp. 123-126, 1 table.

I. — In most life processes the substances formed at a given moment are broken down suddenly. If the reaction forming the substance has a different temperature coefficient from that which destroys it interesting conditions may arise. The author has made a mathematical study of the relations of these coefficients.

II. — In order to find out the nature of the causes determining the natural duration of life of metazoa, a quantitative method is required which

will permit the duration of life to be represented as the numerical function of one variable. Taking as a basis the fact that, in this case, chemical conditions in the organism are one of the main variables, attempts were made to determine whether there were a definite temperature coefficient for the duration of life, and whether this coefficient were of the order of magnitude of that of a chemical reaction. The first experiments, made on fertilised and unfertilised eggs of the sea urchin, could only be carried out at the upper temperature limits of the organism, because, at ordinary temperatures, this organism lives for years. It was, therefore, necessary to use a form whose duration of life was short enough to measure the duration of life, even at the lowest temperatures; insects are specially fit for this purpose. As METCHNIKOFF had pointed out that bacterial poisoning may shorten the duration of life, "aseptic" (*i. e.* microorganism-free) fruit flies (*Drosophila*) were chosen.

Previous experiments made by the authors had shown that, with a proper and adequate supply of food, the duration of the larval, pupal and imago stages are each an unequivocal function of the temperature, and that the temperature coefficients for each stage are approximately identical, and are of the order of magnitude of that of a chemical reaction, *i. e.* about 2 or more for a difference of 10°C. The experiments described deal with the two main factors determining the duration of life: 1) food supply; 2) temperature. All were carried out with flies rendered "aseptic" by a combination of the methods of BOGDANOW-DELCOURT and GUYENOT.

1) INFLUENCE OF DIFFERENT KINDS OF FOOD. — The period of growth is limited to the larval stage. Larvae cannot grow on glucose-agar unless yeast is added, whereas the imago can live without yeast. This difference may be due to the fact that the larva requires food for the synthesis of the compounds of its body, whereas the perfect insect, which does not grow, can do without such accessory substances, or needs them in such small quantities that they can be supplied by the hydrolytic processes within its cells.

The flies from the larvae fed on yeast were placed on different culture media immediately after hatching. It was found that, at 25°C., flies fed on agar alone or on agar with the necessary salts lived less than 2 days; when dextrose and salts were added to the agar they lived over 8 days, and on glucose-agar they lived 28.5 days. At 30°C. the flies lived as long on glucose-agar alone as when yeast was added (see Table I).

TABLE I. — *Effect of food on the duration of life of the imago (both sexes).*

Food	1 gm. washed agar + 100 cc. water	1 gm. agar 0.1 gm. $K_2HPO_4$ 0.1 gm. $MgSO_4$ 100 cc. $H_2O$	1 gm. agar 0.1 gm. $K_2HPO_4$ 0.1 gm. $MgSO_4$ 2.0 gm. dextrose 100 cc. water	Glucose agar		Glucose agar + 6 gms. yeast per 100 cc.
				a	b	
Temperature . . . . .	25°	25°	25°	25°	30°	30°
Average duration of life; days. . . . .	1.92	1.75	8.25	28.5	13.7	13.1

There was also found to be an influence of sex: — on glucose-agar isolated males lived longer than isolated females or than mixed groups (see Table II).

TABLE II. — *Effect of sex (30° C. and glucose-agar food).*

Sex	♂ ♂ ♀ ♀	♂ ♂	♀ ♀
Duration of life; days . . . . .	13.1	15.7	13.3

2) INFLUENCE OF TEMPERATURE. — *Larval period.* — The aseptic cultures, in Erlenmeyer flasks, were kept in water-jacketed incubators regulated to  $\pm 0.1^{\circ}$  C. and containing water so that the humidity was always about 100 %. The eggs from the aseptic insects were put in the incubator and hatched very soon after they were laid. The duration of life of the larvae was reckoned from the time the eggs were placed in the incubator till the time the pupae were formed. Six to ten cultures were

TABLE III. — *Influence of temperature on the duration of larval period of Drosophila.*

Days elapsed after hatching of eggs		Number of pupae formed at							
Days counted	Average	10° (?)	15° (?)	20° (?)	25°		27.5° (?)	30° (?)	31.5° (?)
					a (?)	b (?)			
1-2	1.5	—	—	—	—	—	—	—	—
2-3	2.5	—	—	—	—	—	—	—	—
3-4	3.5	—	—	—	—	4	156	93	63
4-5	4.5	—	—	—	53	29	105	129	333
5-6	5.5	—	—	—	137	18	12	6	254
6-7	6.5	—	—	47	78	—	—	—	52
7-8	7.5	—	—	65	36	—	—	—	—
8-9	8.5	—	—	68	—	—	—	—	—
9-10	9.5	—	—	16	—	—	—	—	—
13-14	13.5	—	2	—	—	—	—	—	—
15-16	15.5	—	13	—	—	—	—	—	—
17-18	17.5	—	27	—	—	—	—	—	—
19-20	19.5	—	14	—	—	—	—	—	—
21-22	21.5	—	6	—	—	—	—	—	—
39-48	43.5	5	—	—	—	—	—	—	—
49-58	53.5	20	—	—	—	—	—	—	—
59-68	63.5	13	—	—	—	—	—	—	—
69-78	73.5	3	—	—	—	—	—	—	—
Total number of pupae . . . . .		41	62	196	304	51	273	228	702
Average duration of larval period in days (from egg to pupation) . . . . .		57.0	17.8	7.77	5.82	4.76	4.15	4.12	4.92

(1) Flies used were of the 20th. to 22nd. aseptic generation.

(2) Flies used were of the 29th. to 31st. aseptic generation.

made for each temperature. Temperatures less than 10°C. could not be used, since the larvae do not hatch below that temperature. The results (see Table III) clearly show the influence of temperature.

*Pupal stage.* — A similar influence is noticed on the duration of the pupal stage, calculated from the formation of the pupa to the emergence of the winged insect.

*Imago stage.* — A similar influence.

To sum up, temperature influences the duration of all three stages, and, consequently, the total life duration of the fruit fly. (See Table IV).

III. — A third series of similar experiments showed that a prolonged period of growth prolongs the total duration of life. It has been seen that, in the case of the "aseptic" *Drosophila*, growth may be greatly retarded by absence of yeast. The prolongation of the larval stage affects neither the duration of the pupal stage nor (as is shown by these last experiments) that of the imago stage. This proves the relative duration of each of the three stages to be independent of that of the other two stages; this coincides with the hypothesis that the duration of each of these stages is determined by the formation or disappearance of a definite specific substance.

TABLE IV. — *Influence of temperature on the total duration of life (Drosophila).*

Temperature	Duration, in days, of			Total duration life from egg to death
	Larval stage	Pupal stage	Imago stage	
10°	*57.0	Pupae die	120.5	177.5 + X
15°	17.8	13.7	92.4	123.9
20°	7.77	6.33	40.2	54.3
25°	5.82	4.23	28.5	38.5
27.5°	(4.15)	3.20	—	—
30°	4.12	3.43	13.6	21.15

182 - Physiological Effect on Growth and Reproduction of Rations Balanced from Restricted Sources. — HART, E. B., MC COLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., in the *Journal of Agricultural Research*, Vol. X, No. 4, pp. 175-198 + Plates 18-32. Washington, D. C., July 23, 1917.

This paper summarises the results of further studies on the physiological value of restricted rations. The early work of the writers (1) demonstrated clearly the inadequacy of the accepted theory as to what constitutes a balanced or complete ration. Up to that time total protein (without reference to quality), energy, and ash materials were considered the essentials of a ration. The latter, however, occupied no position in the expression of the standards developed which have been stated only in terms of total digestible protein and energy. It is, however, probably

(1) MC COLLUM, E. V., STEENBOCK, H. and HUMPHREY G. C., *Idem*, in *Wisc. Agr. Exp. Sta. Res. Bul.* 17, pp. 131-205, 24 fig. Madison, Wisc., 1911.

true that, in a practical sense and with the generally accepted knowledge of the quality of feeding materials accumulated from a long and varied experience, such standards have had and will continue to have very great value; but their limitations are also made evident by this earlier work of the writers and are emphasised by what they have since done.

To day a ration can be considered complete and efficient only when it contains protein of adequate quantity and quality, adequate energy, ash materials in proper quantity and proportion, and two factors of unknown constitution (vitamines) which the writers have designated as "fat-soluble A" and "water-soluble B". In addition to these normal factors, there may be introduced with natural foodstuffs the important factor of toxicity. This can be wholly absent or so mild in its effects as to be entirely obscured when the other essentials of a ration are at an optimum adjustment.

#### EXPERIMENTAL WORK STARTED IN 1910 ON WHEAT AND CORN RATIONS.

— In order to locate the deficiencies of the all-wheat-plant ration (wheat grain, wheat gluten, and wheat straw), which had given fair growth, but was a failure in reproduction with grade Shorthorn heifers, a new series of experiments was again started in 1910, using for the purpose vigorous grade Holstein heifers of initial weights of from 200 to 400 pounds. It was also proposed that one group should receive its nutrients wholly from the corn plant, another from the wheat plant, a third from corn grain and wheat straw, a fourth from wheat grain and corn stover, while a fifth group should receive its nutrients from corn grain with the roughage equally divided between alfalfa hay and wheat straw. These rations were closely comparable in digestible proteins and net available energy and were balanced in the ordinary sense of the standards. The animals were fed what they would consume of this mixture and, in addition, received common salt and natural water. They were allowed a daily run to an outside paddock free from all vegetation. Their records of growth and final status are given in Table I.

Restriction to the wheat plant as a source of "balanced" nutrients did not sustain the growth of the heifers. Such animals also failed to show oestrus and could not be bred. Marked pathological conditions resulted, such as blindness, feeble and emaciated condition, and abnormal excitability followed by collapse. The critical factors in this ration were poor mineral content and toxicity. This statement is based on records made by other animals of this species and on records with rats and swine.

In contrast to the all-wheat-ration group stood the all-corn-ration group. The latter not only showed continuous growth, but became physiologically active and produced strong calves. The decline in weight at the end of two years shown by No. 575 was due to slow recovery after calving.

By the use of corn stover as a roughage in place of the wheat straw, growth was sustained but reproduction was only partially successful, dependent upon the stamina of the mother. Where reproduction was successful in the first gestation period, it failed in the second, owing to the cumulative effect of the wheat toxicity.

By the use of alfalfa hay to take the place of one-half of the wheat



straw, results similar to those with corn stover were secured. Growth was splendid, reproduction normal in the first gestation period, but weakness appeared in the second gestation.

TABLE I — *Record of Growth of Holstein calves 1910-1912.*

No. of Animal	Ration	Weights in pounds					Condition after 2 years
		Initial (June 2, 1910)	After 6 months on ration	After 1 year on ration	After 18 months on ration	After 2 years on ration	
629	Ground wheat, 8 pounds						
	Wheat gluten, 0.3 pounds	377	655	569	610	452	Miserably emaciated.
639	Wheat straw, 5.7 pounds						Do.
	do	406	722	683	630	519	
637	Wheat grain, 6.7 pounds						
	Wheat gluten, 0.3 pounds	206	369	533	656	790	Fairly strong.
641	Corn stover, 7 pounds						
	do	207	377	594	783	820	Do.
575	Corn meal, 5 pounds						
	Gluten feed, 2 pounds	349	664	970	1139	974	Strong and vigorous.
594	Corn stover, 7 pounds						Do.
	do	270	496	735	905	923	
635	Corn meal, 5 pounds						
	Gluten feed, 3 pounds	208	301	480	591	690	Poor growth and poor condition
636	Wheat straw, 1 pounds						Do.
	do	220	384	541	684	642	
942	Corn meal, 5 pounds						
	Gluten feed, 2 pounds	—	613	686	911	1161	Strong and vigorous
643	Wheat straw, 3.5 pounds						
	Alfalfa Hay, 3.5 pounds	—	537	602	800	788	Do

The alfalfa and corn stover introduced a better salt mixture, a little different protein mixture, and probably a more plentiful supply of growth-promoting substances, all of which, according to the writers' hypothesis, would either individually or collectively improve the ration but not necessarily make it perfect. It might still fail if the mass of toxicity was too large.

Baking the wheat grain did not improve it. The particular effect of these all-wheat-grain rations was to cause marked histological changes in the nervous tissues of the offspring. The motor cells partly degenerated and the spinal cord showed a more or less oedematous condition. This was analogous to the writers' observations on swine with wheat-grain feeding. On wheat-grain and wheat-straw rations growing heifers also showed symptoms of nerve degeneration, as evidenced by blindness and great excitability. The cause of the disturbance was due to the inherent toxicity of the wheat grain and not to "deficiencies of vitamins".

Corn grain plus wheat straw allowed sustained growth, but at a slow rate. The offspring were weak or dead. Addition of salt to this ration made it normal, indicating that this was the only factor needed for perfect nutrition with this ration.

A physiologically complete ration such as the corn-grain and corn stover mixture could not be disturbed, at least in a single gestation, by

altering the calcium-magnesium ratio through the addition of magnesium salts. Even the addition of mineral acids to this ration, in such quantities as to make the urine of the individuals receiving it acid to litmus and rich in ammonium salts, did not disturb its nutritive completeness.

The addition, however, of wheat embryo to a corn ration did cause disturbances, bringing about early abortions. This was due to its high content of the toxic material of the wheat kernel.

Considering the influence of these investigations on practice, the writers point out that there is already much trouble with reproduction by cows in the Dakotas, wherever much wheat straw is fed with corn grain. In many cases where the breeding stock was only fed wheat grain and certain roughages, the calves were born either dead or weak, with great financial losses to many breeders. No one would have suspected that the ration was a factor in these disasters, but it undoubtedly was the direct cause of the trouble.

The data presented include also the study of the influence of these factors on milk secretion.

183 — On the So-Called Specificity of the Abderhalden Reaction. — BOLDYREFF, W. N., in *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 18, pp. 882-884. Paris, November 24, 1917.

The ABDERHALDEN reaction is based on the fact, as yet unproved, that the ingestion of albuminoid substances causes the appearance of specific proteolytic ferments in the blood.

For 16 years, the author, in collaboration with M. J. KNIAZEFF, has has been carrying out researches on the work of digestion, as distinct from digestion. These researches, which have been carried out on 10 persons, hundreds of dogs, cats and birds, throw new light on the ABDERHALDEN reaction.

Contrary to general belief, the stomach and the intestine with its glands do not remain inactive after digestion; on the contrary, these organs carry out a well defined and intense work which is regularly interrupted by periods of complete repose. This activity of the stomach and of the intestine with its glands, which takes place during fasting, has been called "periodic work of the digestive apparatus apart from digestion". This is what takes place: the animal being fasting, and the gastric glands quite inactive, from time to time, with the regularity of clockwork, the pancreatic and intestinal glands as well as the gall-bladder, produce a secretion; this secretion is accompanied by intense rhythmic contractions of the stomach and small intestine.

This simultaneous "work" of the organs in question lasts from 20 to 30 minutes in the dog, and a little longer in man; the consecutive phase of "rest", which affects all the organs in question at the same time, lasts about an hour in the dog, and a little less in man.

During each period, 25 to 30 cc. of a mixture of digestive juices can be withdrawn from the duodenum of the dog, and 50 to 60 cc. from that of man. These juices contain abundant intestinal ferments that act on albu-

minoids, fats and carbohydrates; they are afterwards absorbed without change in the small intestine and never reach the large intestine.

Experiments by M. KNIIZEFF and the author have shown that these ferments, one of which is a proteolytic ferment, penetrate, during the period of "work", into the blood, where they can be easily demonstrated. During the "rest" periods the ferments in question disappear from the blood. These appearances and disappearances take place with the greatest regularity, a fact that forms the first cause of error in the ABDERHALDEN reaction.

The second error is as follows: If the blood of a man or woman is examined during the period of work of the digestive apparatus, it is found that the ABDERHALDEN reaction gives a positive result with any albuminoid substance (placenta, lungs, fibrin, etc.) On the other hand, if blood be examined that has been obtained during the rest period from the same subject on the same day, the ABDERHALDEN reaction always gives a negative result, even with gravid females.

As this reaction is not specific, the author concludes, it has no diagnostic value, but it is very useful for showing the presence of proteolytic ferments in the blood.

184 - Influence of Date of Cutting on the Food Value of Hay; Experiments carried out in Denmark. — KAISTEN, IVERSEN and KRISTENSEN, R. R., in *Tidsskrift for Planteavl*, Vol. XXIV, Pt. 3, pp. 405-435. Copenhagen, 1917.

FEEDS  
AND FEEDING

The experiments described were carried out at the agricultural School of Naesgaard in order to determine to what extent the date of cutting influences the composition and yield in hay of clover, either alone or mixed with fodder grasses. The dates of the first cutting were: June 16, when the clover began to flower; June 26, when the clover was in full flower and the grasses began to flower; July 9, when the clover had already partly lost its flowers.

QUANTITY OF FODDER. — The date of the first cutting seems to have no influence on the *total* yield of the three cuttings; the third cutting diminishes in quantity with the later date of the first cutting.

TABLE I. — Relation of quantity of hay to the date of the first cutting.

1st. cutting		2nd. cutting		3rd. cutting		Total Cwt.
Date	Cwt.	Date	Cwt.	Date	Cwt.	
June 16.	52.70	August 9.	24.98	October 15.	8.10	86.00
June 24.	52.62	August 15.	28.32	October 15.	6.98	87.98
July 9.	55.24	September 11.	30.88	October 15.	1.72	87.90

CHEMICAL COMPOSITION. — This is shown in Table II; the moisture content is 15% for all samples.

TABLE II. — *Composition of hay cut at different dates.*

	Early cutting	Late cutting
Albuminoids . . . . .	10.2	8.5
Fat . . . . .	2.6	2.5
Fibre . . . . .	20.0	22.1
Nitrogen-free extract. . . . .	30.8	31.0
Pentosans . . . . .	13.3	14.0
Ash . . . . .	8.2	6.8
Moisture . . . . .	15.0	15.0

Hay cut early is distinguished by its high albuminoid content and by its ash percentage, whereas it is relatively poor in fibre and pentosans.

EXPERIMENTS WITH DAIRY COWS. — The date of cutting does not influence the composition of milk, but influences its production to a marked degree; with 200 lbs. of hay cut early 16.28 lbs. more milk were obtained than with an equal quantity of hay cut late.

EXPERIMENTS ON THE GROWTH OF CALVES. — The experimental animals were divided into three groups. Care was taken to choose calves of equal age and weight so that an increase in weight could be with certainty attributed to the hay. The most important results are summarised in Table III.

TABLE III. — *Experiments with calves fed on hay cut at different dates.*

Increase in weight each 10 days			
	Early cutting	Normal cutting	Late cutting
	lbs.	lbs.	lbs.
Year 1913. 1st. period. . . . .	12.28	11.44	10.78
Year 1913. 2nd. period. . . . .	11.66	10.56	9.68
Year 1914. 1st. period. . . . .	10.56	9.46	7.92
Year 1914. 2nd. period. . . . .	13.42	10.78	8.80
Year 1915 . . . . .	8.68	—	6.38
Averages of 4 experiments 1913, 1914. . . .	12.10	10.56	9.24
Averages of 5 experiments 1913, 1914, 1915.	11.44	—	8.80

During a period of 100 days the following increases in weight were obtained: — hay cut early, 121.00 lbs.; normal hay, 107.80 lbs.; hay cut late, 92.40 lbs. The early hay, therefore, gives the best results.

DIGESTIBILITY. — These experiments were carried out with two animals fed exclusively on hay cut early and hay cut late.

The greater digestibility of early-cut hay and its greater number of calories explain the higher production of milk and more rapid growth of the calves.

TABLE IV. — *Digestibility of hay according to the date of cutting.*

	A) Early cutting	B) Late cutting	Difference A-B
	%	%	%
Dry matter . . . . .	60.8	53.7	7.1
Protein . . . . .	72.6	60.9	11.7
Pentosan . . . . .	60.6	54.1	6.2
Fibre . . . . .	53.2	46.3	6.9
Ash . . . . .	42.4	34.8	7.6

185 — **The Feeding Value of the *Eragrostis* of the Argentine.** — See No. 165 of this *Review*.

186 — **The Insufficiency of Maize as a Source of Protein and Ash for Growing Animals.** — HOGAN, ALBERT G. (Department of Chemistry, Kansas State Agricultural Experiment Station, Manhattan, U. S. A.), in the *Journal of Biological Chemistry*, Vol. XXIX, No. 3, pp. 485-493, 3 diagr. Baltimore, Apr. 1, 1917.

Agriculturalists have known for a long time that maize kernel does not suffice as a diet for growing animals. Experiments on young rats have shown the first limiting factor for growth to be a lack of certain inorganic constituents. When the mineral deficiencies were corrected normal growth was not obtained, even after the addition of considerable quantities of purified protein, thus proving a lack of suitable growth accessories. According to MC COLLUM, and his collaborators, maize kernel is lacking in an accessory, called by them "fat-soluble A". (1). The author's previous experiments show that mineral deficiencies in maize are tolerated much better by swine, and protein deficiencies are tolerated better by rats. Assuming that maize is poor in one or more of the growth accessories, swine are much less affected by it than are rats.

The author has continued his earlier work in order to determine specifically what inorganic elements in the ash, and what amino-acids in the proteins are deficient in quantity, thus constituting limiting factors. It was first shown that the addition of tryptophane and lysin improved the proteins of maize, and later, that tryptophane is the first limiting factor in the proteins of the maize kernel, and that lysine is the second. The most important mineral deficiency of maize is calcium.

187 — **The Effects of Feeding Calcium Chloride to Domestic Animals (2).** — LOEW, O., in *Mitteilungen der Deutschen Landwirtschafts-Gesellschaft*, Year XXXIII, No. 37, pp. 591-594, Tables 3. Berlin, September, 1917.

The rational use of calcium chloride in feeding domestic animals gives good results, both in increasing the general production as in improving an unhealthy condition. These results are very useful, especially when the relatively small amount of chloride required and its low price are considered.

(1) See R. Jan., 1918, No. 2. — (2) See R. 1915, No. 406 (Ed).

The writer analyses the effects produced, and collates the results obtained by various workers for horses, cattle and pigs.

**HORSES.** — An experiment was made by THUNN on 7 full-grown horses affected with gastric and cardiac troubles. Their daily ration was made up of 1 kg. of oats, 750 gm. of whole maize, 1250 gm. of raw sugar and 7 kg. of hay, plus a daily dose of 30 gm. of crystalline calcium chloride dissolved in 250 gm. of water. The experiment lasted from March 6 to May 29, 1916. During these eight weeks the animals showed a noteworthy increase in live-weight (see Table I), as well as an improved state of health. Calcium chloride cures animals of bad habits such as crib-biting, licking the walls, eating sand, etc. — habits that appear to show the lack of some necessary element in the food and also prevents other troubles, such as exostoses, so common in young horses. The results are all the more evident, the lower the calcium content of the food. It is thus desirable to take account of the abundance or lack of lime in the food given; the minimum content is 10 gm. of lime per kg. of hay. Very often this amount is not reached; in addition, pastures on soil poor in lime, manured only with kainit, superphosphates or basic slag, can only produce a defective food, often producing deformed front legs, exostoses, etc. (WEYGOLD).

TABLE I. — *The effect of calcium chloride on the growth of horses.*

Names of the horses	Weights found during the experiment							Increase in weight at the end of the experiment
	March 6th.	March 20th.	April 3rd.	April 17th.	March 1st.	May 13th.	May 29th.	
Patron . . . . .	475 kg	482 kg	484 kg	495 kg	495 kg	497 kg	—	22 kg
Luzia . . . . .	—	462	473.5	480.5	494.5	496.5	—	34.5
Schleier . . . . .	—	354	370	377	372	360	364 kg	10
Salome . . . . .	—	407	407	416	424	479	—	17
Nusshäher . . . . .	—	400	401	402	403	412	414	14
Rektor . . . . .	—	—	383	376	389	394	413	29
Nichte . . . . .	—	—	367	369.5	381.5	393.5	—	26

**CATTLE.** — Calcium chloride also produces good effects on the general growth and milk production. A group of 10 cows and 2 sick young animals were experimented with for 28 days by HOFUKE. The daily dose was from 0.02 to 0.04 gm. per kg. live weight for the cows and from 0.01 to 0.02 gm. per kg. for the young animals. The full-grown animals, of which 2 were sick, were about 5 years old. The weights of the animals and the daily yield of milk are given below in Tables II and III.

The increased yield in milk of 5 of the experimental animals is characteristic and, in certain cases, an increase in yield of 1.1 litres per day has been observed; on discontinuing the use of calcium chloride, the yield immediately falls. The young animals showed the benefit of giving calcium chloride; they grew better, their rough hair became smooth and lustrous and they became fatter.

TABLE II. — *Effect of calcium chloride on the live weights of the cattle experimented with.*

		Live weight		Increase (+) or decrease (—) of live weight
		Before using calcium chloride	After using calcium chloride	
Cow No.	1 . . . .	500 kg	544 kg	+ 44 kg
" "	2 . . . .	460	467	+ 7
" "	3 . . . .	440	462	+ 22
" "	4 . . . .	440	460	+ 20
" "	5 . . . .	480	517	+ 37
" "	6 . . . .	510	484	— 26 (sick)
" "	7 . . . .	450	473	+ 23
" "	8 . . . .	570	580	+ 10
" "	9 . . . .	430	405	— 25 (sick)
" "	10 . . . .	400	434	+ 34
1st. young animal . .		100	107	+ 7
2nd. " " . .		90	97	+ 7

TABLE III. — *Effect of calcium chloride on milk production.*

		Average milk produced in litres		
		Before use 1st. period (7 days)	During use 2nd period (28 days)	After use 3rd. period (21 days)
Cow No.	1 . . . .	7.535	8.250	7.135
" "	2 . . . .	9.820	9.660	8.990
" "	3 . . . .	8.175	8.295	5.595
" "	4 . . . .	5.070	5.555	4.455
" "	5 . . . .	5.570	6.125	4.455
" "	6 . . . .	13.140	12.920	9.155 (sick)
" "	7 . . . .	8.070	8.270	7.015
" "	8 . . . .	3.460	2.180	—
" "	9 . . . .	7.785	7.065	5.610 (sick)
" "	10 . . . .	6.070	5.700	6.100

FIGS. — Two sows were experimented on by STADELMANN; one, used as a control, weighed 126 kg.; the other, weighing 195 kg., was given 14 gm. of crystalline  $\text{Ca Cl}_2$  every day; the second animal put on 9 kg. in 22 days, while the first only increased in weight by 5 kg. It should be noticed that 14 gm. is too heavy a dose; a suitable dose would be 4 gm. per 100 kg. live-weight; better results are then obtained. Speaking broadly, the nature of the food given should be considered, on the one hand, as well as the fact that a young animal eats much more in proportion to its weight than a full-grown animal.

CONCLUSION. — Calcium chloride can be very usefully fed to live-stock when the food is lacking in calcareous matter; moreover, when the food only contains this matter in slightly assimilable form, the chloride is then the most suitable salt to give.

## CATTLE

## 188 - Increased Cattle Production on South-Western Ranges of the United States. —

JARDINE, J. T. and HURTH, L. C., in *U. S. Department of Agriculture, Bulletin* No. 588, pp. 1-32. Washington, D. C., November 15, 1917.

This bulletin presents the results of experiments made by the Forest Service on the Jornada Range Reserve, a unit comprising 200 000 acres in New Mexico, with the purpose of working out a system of range management and improvement, practicable for large grazing units, which will build up the depleted areas and ensure the maintenance of the whole range in good condition.

The problem involves : — a) Finding a system of management that will best bring about natural reseeding of the existing forage plants, b) finding new plants suitable for seeding on the ranges of the Southwest ; c) determining the number and distribution of stock-watering places necessary for efficient use of the range, taking into account cost of construction and returns expected ; and d) determining the carrying capacity of the range as a means of preventing its being overstocked. Other and related range problems also have been studied on the Jornada Reserve. One of these has to do with improving the average grade of stock and the average calf crop under range conditions, the possibility of which is generally recognized. Another is how to reduce the losses of stock from lack of feed and water in times of drought and from disease and straying that ordinarily occur in the Southwest.

These studies on the Jornada Reserve are by no means completed ; the results so far secured, however, seemed to have an important enough bearing on the problem of increased meat production, to justify the publication of this progress report which illustrates methods already successfully applied on a practical scale since 1912 when the Reserve was created by Executive order.

The Jornada Range Reserve is located in Dona Ana County N. Mex., in the Rio Grande Valley, about 50 miles north of the Mexican boundary. It is typical of a large territory in the Southwest which, owing to natural and climatic conditions, will probably always be best adapted to the production of live stock on comparatively large holdings.

The eastern portion of the Reserve includes the west slope of the San Andreas Mountains which reach a maximum elevation of about 7 600 feet, and the remainder of the Reserve is a comparatively flat or slightly rolling plain.

The locality is one of the most arid of the Southwest. Records for 55 years at Mesilla Park, about 15 miles southwest of the Reserve, show an average annual precipitation of 8.63 inches, with precipitation for individual years as much as 17 and as little as 3.50 inches. Temperatures as high as 106° F. are common in summer, and the region is subject to almost continuous high winds and, consequently, high evaporation. The soils of the plain are rather coarse to medium textured wind-blown sands, with patches of heavy adobe clay, usually with a rather high percentage of alkali, where water often stands until evaporated. The soils of the mountains and the outwash plains flanking them are coarse sands and gravels.

The vegetation is comparatively thin and made up of drought-resistant,



semidesert species. By far the greater part of the forage, perhaps 80 %, is furnished by perennial grasses, of which the most important are grama grasses.

Black grama (*Bouteloua eriopoda*) is the most important grass of the Reserve. Blue grama grass (*B. gracilis*) and hairy grama grass (*B. hirsuta*) are found only in the mountains and foothills.

Next to the grama grasses in importance are three-awn grasses known locally as "needle grasses" (*Aristida longiseta*, *A. pansa*, and *A. purpurea*); tobosa grass (*Hilaria mutica*).

The drop-seed grasses include several species, the most important being *Sporobolus cryptandrus*, *S. flexuosus*, *S. wrightii*, *S. airoides*, *S. auriculatus*.

The most important species of muhlenbergias are *Muhlenbergia gracillima* and *M. porteri*.

Burro grass (*Scleropogon brevifolius*) and wolftail (*Lycurus phleclides*) are also to be found.

On large areas of the foothills, black brush (*Flourensia ceruna*), creosote bush (*Covillea glutinosa* = *Larrea glutinosa*) and mesquite (*Prosopis glandulosa*) predominate; but black brush and creosote bush are worthless as forage, and the mesquite is of low value.

Stock water for the plains, both on the Reserve and on the adjacent range lands, is pumped from deep wells by windmills and engines or is provided by tanks which catch the flood waters. As a usual thing, there is not enough water for the stock.

EXPERIMENTAL RESULTS SO FAR OBTAINED IN RANGE MANAGEMENT. — *Range Improvement by Natural Revegetation.* Primarily as a result of 1) reducing the number of stock during the main growing season of about four months — July to October — to about half the average number the area will carry for the year, 2) not overstocking during the other eight months, and 3) better distribution of stock watering places, grama grass range on the Jornada Range Reserve has improved in three years at least 50 per cent. as compared with similar adjoining unfenced range grazed all the year. Observations to date indicate that range thus lightly grazed during the main growing season has improved approximately to the same extent as similar range protected from grazing the entire year.

On fenced grama-grass ranges of the Southwest where the stock are carried mainly on range feed throughout the year, light stocking during the growing season is profitable.

It will probably not reduce the total animal-days' feed furnished on a given area during the year, and will reserve feed for the critical period from February to July, or later in case of prolonged drought.

Where the whole of a range unit is made up of grama or similar grass, about one third of the area should probably be reserved for light grazing during the growing season two years in succession. Each third in turn should be given as nearly as practicable this amount of protection. By light grazing is meant grazing by not more than half the average number of stock that the area will carry for the year as a whole.

*Water Development.* — Fairly efficient use of plains and mesa range in the Southwest can be secured where stock do not have to travel more than

2 ½ miles to water. This means one watering place for each 13 200 acres. Such an acreage of grama-grass range will carry about 500 cattle throughout the year if properly managed. When feed is short, a long distance between feed and water tends to increase the loss of stock, to decrease the calf crop, and to retard development of the young animals.

Observations to date appear to justify one permanent watering place for each 500 head of cattle. Where conditions are favorable the construction of tanks to catch flood waters for the purpose of supplementing the permanent watering places will be a paying investment.

They will aid: 1) in getting more green feed for the stock during the year; 2) in more even utilization of the range as a whole; 3) in the protection of feed and range near permanent water; and 4) in reducing the cost of maintenance and operation of wells.

*Carrying Capacity.* — During 1916 the Jornada Reserve as a whole supported one animal, not including unweaned calves, on an average of 41.45 acres. The estimated maximum carrying capacity of the Reserve in its present stage of development is 38.1 acres per head. The estimated carrying capacity of similar unfenced range in its present average condition is at least 50 acres per head.

The range of the plains, where grama grasses form the bulk of the forage, will support stock throughout the year at the average rate of one head to from 20 to 30 acres, depending upon the proportion of the real grama-grass type. This figure is for range in good condition, fairly well supplied with stock water, and which is lightly stocked during the growing season.

The range comprising tobosa-grass flats, along drainage lines, and slopes back to the foothills will support stock throughout the year at the average rate of one head to from 38 to 45 acres, depending upon the percentage of tobosa flats which receive flood water.

¶ The mountain range of the Jornada Range Reserve will support stock at the rate of approximately 60 acres per head in its present stage of development.

*Increase in Calf Crop and Improvement in Grade of Stock.* — From 500 selected cows and 20 bulls, held in pastures away from other stock since August 1915, an 81 per cent. calf crop was branded in 1916.

From the remaining cows of breeding age, amounting to 1 522 head run together in one pasture of 74 714 acres, a 69.2 per cent calf crop was branded. The average calf crop for the Reserve was 72 per cent. A total of approximately 50 pounds of cottonseed cake per head was fed to the 500 cows and 20 bulls of the selected breeding herd on the Reserve.

¶ The work of caring for this herd took half of one man's time. The extra calves in this special herd far more than paid for the extra feed and labour.

*Prevention of Loss.* — The average loss of stock on the Jornada Reserve from June 1 to December 31, 1915, was at the rate of 1.9 per cent. for a year; the average loss in 1916 was 1.5 per cent. The average losses for New Mexico are approximately 10 6 per cent for calves to 12 months of age, 5.6 per cent. for yearlings, and 5.8 per cent for other stock.

The small loss at the Jornada Reserve is attributed to careful systematic vaccination against blackleg, to the reservation of grama grass range for  
[1916]

poor stock during the critical spring months, to feeding the animals a small quantity of cottonseed cake and to prevention of straying.

In order to provide for extra range for the breeding stock in poor years, one third of the stock on a range unit should be steers. It is then possible to reduce or increase the stock according to years without interfering with the breeding stock.

To provide against loss in extremely bad years some kind of roughage to supplement the range forage, for feeding with cottonseed cake or other concentrated feed, would be a decided advantage on southwestern ranges.

Ensilage made from soap weed (*Yucca elata*) has been tried, and the results are promising but not extensive enough to warrant definite conclusions.

Range feed not more than 2  $\frac{1}{2}$  miles from water is a big factor in cutting down loss from starvation, especially where little or no supplemental feeding is done.

**189 - The Awankari Cattle Herd of the Peshawar Agricultural Station in the North-West Frontier Province of India.** — BROWN, W. ROBERTSON, in *The Agricultural Journal of India*, Vol. XII, Part IV, pp. 588-592. Calcutta, October, 1917.

In the autumn of 1916 ten beautiful typical Awankari cows were introduced, from their home in the North Punjab, to the Peshawar Agricultural Station. Awankari cattle, although alien to the North-West Frontier Province, are valued above other breeds by the cultivators, because they are hardy, handy, powerful and fast alike in the cart and in the plough, and handsome in appearance. Their even black and white markings and free bold carriage appeal to breeders; but until these cows arrived at the Agricultural Station there was not a pure-bred female of the breed in the Peshawar district.

*Awankari Herd at the Peshawar Agricultural Station.*

*Cows.*

Name	Age, years	Length	Height	Girth	Shin	Colour	Price	Calfborn	Remarks
							Inches		
Shirina .	4	48	45 <sup>1</sup> / <sub>2</sub>	63	6	Black and white	85	9- 7-17	A big cow
Badrai .	7	49	47	61	6	»	80	8- 3-17	Rather coarse
Margiana .	4	44	44	59	5 <sup>3</sup> / <sub>4</sub>	»	74	14- 2-17	A fair milker
Zarina .	6	51	47	60	6	»	90	20- 8-16	Beautiful cow
Hussaini .	5	50	47	61	5 <sup>3</sup> / <sub>4</sub>	»	92	4- 5-17	Typical animal
Sesame .	4	50	49	62	6	»	100	12- 2-17	Poor milker
Mahbuba .	4	52	47	64	6	»	100	19- 3-17	Good milker
Niazbina .	3	50	47	60	5 <sup>3</sup> / <sub>4</sub>	»	85	25-12-17	Fair milker
Laila .	7	52	41 <sup>3</sup> / <sub>4</sub>	59	6	»	85	1- 5-17	Good milker
Ranai .	8	48	47	62	6	»	65	—	Typical cow
Bull.									
Rustum .	4	60	51	75	7	»	130 (2 years)		Handsome typical bull
Bullocks.									
	6	54	52	68	7	»	140		A beautiful
	6	57	52	6	6 <sup>1</sup> / <sub>2</sub>	»	140		well-matched pair

Four of the cows are by no means poor milkers, so it is hoped that a herd of fair milkers may ultimately be established without sacrificing any of the more important qualities the breed now possesses. The young stock promise to be excellent typical specimens fit for stud, or inclusion in the Station Herd Book. In the table of measurements given below, the cows compare unfavourably with the bull and bullocks in size and "bone" because the calves were originally generously treated, whilst the females received bare sustenance.

A set of 5 photographs is given in the original text.

## SHEEP

190 - **The New Zealand Sheep Returns in 1917 and the Progress of Crossbreeding in New South Wales.** — *The Pastoral Review*, Vol. XXVII, No. 11, pp. 1040-1041 Melbourne, November 16, 1917.

The complete figures of the New Zealand sheep returns just issued, show that there has been an increase of 482 236 over the previous year. The increase for the North Island is 686 329 and the decrease for the South Island 204 093. The New Zealand figures supply much interesting and valuable information because separate totals are given of stud rams, flock rams, wethers, breeding ewes, dry ewes and lambs.

According to these returns there were in the Dominion 10 484 stud rams, 318 766 flock rams, 3 457 000 wethers, 13 260 000 breeding ewes, 1 072 647 dry ewes, and 7 150 516 lambs. There is also shown the number of stud sheep entered in the flock book, and the sheep of a distinctive breed, but not entered in the flock book. Romneys, Lincolns, Border Leicesters, and Southdowns, the favourite crossing breeds, lead the way, but the first-named is far ahead of the rest, there being 117 478 stud and 3 702 641 flock Romneys, as against 40 083 stud and 585 943 flock Lincolns, which come second. Border Leicester studs and flocks number respectively 35 992 and 311 407, Southdowns 26 393 and 50 019, English Leicesters 24 367 and 173 146, Merinos 17 187 and 1 063 491, and Shropshires 4 109 and 22 380. The number of crossbreds and others not otherwise enumerated is 18 395 222.

The figures for New South Wales also throw an interesting light upon the development of crossbreeding. In the 1907-1908 season the percentage of crossbred wool sold in the Sydney market was 3.77 % of the total offerings. It steadily increased to 8.73 % in 1912-1913, and the following year suddenly increased to 11.05 %. From then onwards progress was more rapid and during the 1916-1917 season the wool sold in Sydney was 21.14 % crossbred and 78.86 Merino. Unfortunately, there are no accurate statistics available illustrating this development in the various pastoral districts of each State. It would be interesting to know whether this increase of crossbred wool is the result of an increasing use of sheep on the wheat areas, or whether the crossbred is making a steady encroachment on to what has hitherto been considered pure Merino country. It would also be most useful to know what Longwool breeds are forming the basis of such marked development in crossbreeding. It is well known that the Romney, Lincoln, and Leicester are the predominating British breeds in New South Wales and New Zealand, that are used for crossing with the Merino, but there are no statistics for the Australian States which can be taken as evidence of

the relative part each breed is playing in this increasing production of crossbred wool.

The 25 270 386 sheep of New Zealand belong to 23 380 different owners, giving an average of a little over 1000 sheep per owner. There are no less than 18 255 owners whose flocks do not exceed 5000 and 11 809 of these owner's flocks do not exceed 500. There are only 38 owners with flocks exceeding 20 000. The number of owners has increased during the year by 199. This increase is partly due to new settlers starting flocks, and to a smaller extent to dairy farmers who have been forced, by shortage of labour, to give up cows for sheep.

191 - **The Importance of Hogs for the Meat and Hides Supply.** — FISH, P. A., in the *Journal of the American Veterinary Medical Association*, Vol. LII, No. 3, pp. 245-247. Ithaca, N. Y., December, 1917.

PIGS

It is estimated that at present there are in the United States 4 000 000 hogs less than there were a year ago. Outside of the United States there has been a decrease of 39 525 000 hogs. This number has been exceeded only by sheep. Cattle are not far behind the hogs in their diminishing numbers.

To assist in meeting the great demand for meat the U. S. Department of Agriculture estimates that the number of hogs should be increased 15 per cent. for the entire country. In some states the increase needed is only 5 per cent., in others, as much as 50 per cent. This policy seems completely justified because among the domesticated animals there are none so prolific; none which produce so great a return in so short a time; none in which so wide a variation in diet is possible; none more useful in the variety of products afforded.

Nevertheless, there is one important product of the hog which does not seem to be used at its best advantage, under modern methods of curing ham and bacon, and that is the hide.

The deficiency in leather is becoming serious and pig skin is the only substitute, in large quantities, available for cowhides. The skins of the millions of hogs slaughtered annually could be converted into the finest kind of leather. Such leather is superior to cow hide in resisting surface wear and has been used for years, but in limited quantities, in making the finest saddles and fancy leather goods. It has been tested and found thoroughly practicable and satisfactory for shoes.

It is stated there is a shortage of three million cowhides to meet in the open market. The pigskins would make up this deficiency twice over considering that the presence of the skin is not indispensable in preserving the meat, under the modern methods of curing.

In the supply of meat and leather, the hogs, as quick breeding animals, seem therefore to meet the need. Unfortunately they are susceptible to diseases which annually take a toll of millions from the supply. But the use of anti-hog cholera serum is to day far beyond the experimental stage. It has checked the disease in the infected herds and immunized healthy hogs exposed to the disease; therefore, with a greater educational interest

and with proper cooperation on the part of the producers and of the veterinarians, it seems only a question of time and organization to avert the menace of hog cholera.

## BEE KEEPING

192 - "Le Sughere" Hive with Cork Frames. — PECCHINI, GIOVANNI, in *L'Apicoltura Italiana*, Year XIII, No. 12, pp. 188-189. Ancona, December, 1917.

In order to protect the bees against heat, cold and especially sudden changes of temperature in spring, the author constructed a hive with cork frames. All models may be built on this system.

193 - The Cotton Plant as a Honey-Yielding Plant. — *Chacaras e Quintas*, Vol. XVI, No. 4, p. 299. São Paulo, October 15, 1917.

It is not generally known that the cotton plant is one of the best honey-yielding plants. The honey obtained from it is very clear and, when it is completely ripe, very sweet. It granulates easily and, when solid, is of a very fine, almost white grain.

## SERICULTURE

194 - Comparative Research on the Value of the Electrical and Chemical Treatments of Silkworm Eggs (1). — ACQUA, C., in *Informazioni Seriche*, Year IV, No. 21, pp. 493-494. Rome, Nov. 5, 1917.

During the spring and autumn of 1917 the author carried out 38 series of experimental rearings, in which he reared, under the same environmental and food conditions, for each series, lots of eggs treated by electricity or hydrochloric acid for a varying duration of time. The races used were native yellow, Chinese white and gold at their first crossing and the product of some of these crossings.

For the hydrochloric acid treatment one of the methods most generally acknowledged to be favourable was used. It consists in treating native yellow eggs with fuming hydrochloric acid diluted in  $\frac{1}{10}$  of water; during 15 minutes, and the Chinese eggs for a few minutes less.

For the electric treatment, electrification of the eggs contained in bags between the two electrodes was sometimes used, but more often "electric rain". The author has so modified this method that the eggs may be subjected directly to the "electric rain", without being placed in silk bags as was done hitherto. By this method, which will be described in a later paper, it is possible to avoid, partly at least, the drawback resulting from a difference in treatment which sometimes occurs with more or less powerful apparatuses during more or less dry periods.

Of the 38 series, 10 gave results slightly favourable to the electric treatment, at least some of the lots giving better results than those treated with hydrochloric acid; 28 gave results distinctly unfavourable to this treatment, for all the worms died before reaching maturity, whereas those from eggs treated with hydrochloric acid always proved much more resistant, and often gave good results. The most prolonged electric treatment appears the least favourable. From these experiments it was concluded that *the electric treatment is clearly inferior to the hydrochloric acid treatment, which, being also the more simple, should be preferred.*

(1) See R. Jan, 1918, No 76 (Ed.)

The loss of weight of the eggs treated with electricity or acid for each day between the treatment and hatching was also studied. The results showed that, within the limits of complete hatching, the loss of weight is in direct proportion to the duration of the treatment, but prolonged treatment often decreases it. The progress of this phenomenon will be shown by tables in the author's coming paper.

Finally it is shown that, when hatching is brought about prematurely by hydrochloric acid, the eggs, though they remain strong, often give bad results on account of the excessive summer heat. This is easily explained if it is considered that annual breeds, which already suffer in hot springs, bear the summer with difficulty.

The special treatment cannot give new vigour to the breed; it must suffice that it does not weaken it appreciably. These methods, like that of prolonged estivation, give good results for breeding at moderate temperatures, but at very hot temperatures, breeds already adapted to these conditions must be used. Crossing with bivoltines should give the desired result. They have already been thoroughly studied with respect to their products and especially the profit they give, and attempts should now be made to use them practically, by solving some of the difficulties which arise.

**195 - Selection by Phototaxy of Newly-Hatched Silkworm Larvae with Regard to their Strength.** — ACQUA, C., in *Rendiconti dell'Istituto bacologico della R. Scuola superiore di Agricoltura in Portici*, Vol. II, pp. 51-77. Portici, 1917.

In his preceding work (1) the author showed that silkworm larvae, on hatching, move towards the light (positive phototaxy), whereas, at later stages, they tend to avoid it (negative phototaxy), and that the larvae showing the most active phototaxy are also the most resistant to "flacherie". In his present work the author has restudied phototaxy on a larger scale, making numerous experiments (33) with many breeds (native yellow, Chinese white, Chinese gold, Chinese bi-yellow) reared in spring, summer or autumn. In order to separate the larvae showing a greater phototactic activity from those showing a lesser, he used an incubator with double walls, the space being filled with water, long enough to hold 8 small frames about 1 foot wide and 3  $\frac{1}{4}$  feet long, with two doors, the back one of wood, the front one of ground glass. A few hours after hatching, there are placed rapidly on different parts of the frames, narrow strips of mulberry leaves, or, better still, on the cloth forming the bottom of the frame, sheets of paper, whose edges overlap, like tiles of a roof. When collecting the mulberry leaves from the different parts, or the sheets of paper, the larvae which have moved most rapidly towards the light are separated from those which have moved more slowly, or not at all. The results of these 33 experiments confirm in every way those of the two preceding studies, and leave no doubt that larvae which show the greatest phototactic activity are also the strongest, grow the most rapidly, are the most resistant to disease and produce the heaviest cocoons.

(1) See R. March, 1916, No. 328; and R. June, 1917, No. 572. (Ed.)

The use of this method of selection in practice has give only negative results in attempts to test the strength of the eggs, at the beginning of spring before their distribution for ordinary rearing. This is because the phototactic reaction varies with the different breeds independently of their strength. This method is also unadapted to ordinary rearing by putting in a room, dimly lit on one side only, a number of eggs exceeding that to be reared and rejecting the slowest-moving larvae, because the number of larvae reacting strongly to light is usually small; the bulk move more or less in a continuous line so that, considering the difference between one breed and another, the rearer has no positive indication of where he must stop. On the other hand, selection by phototaxy may be used as a means of improving breeding races in combination with the method now followed of selecting the silk-worms which live longest.

196 - Studies on the Process of Digestion in Silkworm Larvae. — ACQUA, C, in *Rendiconti dell'Istituto biologico della R. Scuola Superiore di Agricoltura in Portici*, Vol. I, pp. 3-44 and Vol. II, pp. 31-50. Portici, 1916-1917.

By: a) the microscopic examination of microtome sections, embedded in paraffin wax, of various parts of the intestine together with their contents; b) the extraction of the intestinal juice of fasting and non-fasting larvae; c) a study *in vitro* of the properties of this juice, the author was able to ascertain:

1) that the cytoplasmatic substances of mulberry leaves which are expelled from their cells by the rupture of their membranes during mastication, disappear gradually in proportion as the posterior part of the intestinal tube is approached, whereas the cells which remain intact appear to pass through the tube unchanged;

2) the starch granules show no trace of change or corrosion;

3) in the intestinal juice there are one or more proteolytic diastases, similar in character to trypsin, and which, among other properties, have that of digesting coagulated ovalbumen, but it was not possible to ascertain the existence of an amylolytic ferment capable of acting on the starch (contrary to the general opinion that the starch may be utilised) or of lipolytic ferments capable of digesting the fats.

In a second study the author has re-tested the results of his first work by undertaking new research: — a) on the proteolytic ferments in fasting larvae and in larvae which have taken a normal amount of food; b) on the eventual occurrence of amylolytic ferments under the above conditions; c) the possible action of the salivary glands. The presence of invertases was carefully investigated. All these studies, as well as the first ones, were confined to the native yellow breed. The results again confirm the low enzyme content of the intestinal juice of the silkworm, in which the author noted a) a low capacity for inverting cane sugar; b) an energetic proteolytic ferment acting in an alkaline medium (such as trypsin) on the soluble, coagulated ovalbumen, on the fibrin of the blood, on the vegetable proteins (zein). It may be concluded that the silkworm digests food principally, or even exclusively, by means of one or more proteolytic zymases, and can then complete its nutrition by absorbing the soluble carbohydrates (sugars) of the



leaf digested. It has been proved that neither the presence of foodstuffs in the intestinal tube, nor the olfactory stimulant, have even the slightest influence on the secretion of these enzymes. It has been proved beyond all doubt that the starch passes unchanged through the intestinal canal of the silkworm. The eventual action of lipolytic ferments calls for further study.

If the reactions which take place in the digestive canal of the silkworm are very limited from a qualitative point of view of the substances contained in the mulberry leaf, the same may be said of the quantitative point of view, for the silkworm only utilises the substances expelled from the vegetable cells as a result of their rupture during mastication, whereas it appears that no action can take place within the cells, perhaps because of the difficulty the enzymes have to penetrate their walls. Nevertheless, the author states in his second study that, in the longitudinal sections of the middle of newly-hatched larvae, fed at the beginning of spring on very young and very tender leaves, digestion was seen to occur, during the passage through the digestive tube, also within the cells. In newly-hatched larvae the small intestine is much more extended than at the later ages in proportion to the other parts; in the above case a beginning of digestion was also noted near the front intestine.

Consequently, the custom of giving newly-born larvae very tender leaves does not only facilitate digestion, but also facilitates the penetration of the enzymes through the cellular membranes, which, in this case, are very thin and easily penetrated.

Finally, the author made an experimental test with tubes of MERT (coagulated ovalbumen) on the action of the proteolytic zymases of healthy larvae and of those predisposed to "flacherie". No difference was noticed, so that it would appear that the disorders noticed in the intestinal juice of larvae suffering from "flacherie" do not precede the disease, but are a result of it. The author is continuing the study of this question.

197 - On Natural Parthenogenesis in Various Breeds and Varieties of *Bombyx mori* (1). — LÉCAILLON, A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 20, pp. 799-801. Paris, December 3, 1917.

This paper gives the results of experiments carried out to ascertain if the aptitude for natural parthenogenesis in the silkworm varies with different breeds or varieties.

The material used was: — 1) 3 lots, each of about 400 unfertilised eggs, laid by univoltine silkworms giving straw coloured cocoons; 2) 10 lots of unfertilised eggs from accidental bivoltines; 3) 5 lots of unfertilised eggs from a Chinese polyvoltine breed.

The results obtained led to the conclusion that there is a real aptitude for parthenogenesis in all breeds of *Bombyx mori*, but there are many variations in the degree of development of this aptitude. The parthenogenetic transformations which take place in the egg may stop at a stage which appears to be extremely early, or continue till a larva is produced capable of living and developing just as well as those from fertilised eggs.

(1) See R. October, 1917, No. 936 and November, 1917, No. 1050. (Ed)

198 - Note on Sericulture in Madagascar (1). — FAUCHÈRE in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 20, pp. 676-677. Paris, November 12, 1917.

The author, being entrusted with the reorganisation of the sericultural service in central Madagascar, was able to make new observations which he reports in the present note.

The races of *Sericaria mori* introduced into Madagascar come from the South of Europe and were all monovoltine. After two years, by adaptation to the climatic conditions in the centre of the island, they became polyvoltine, breeding six generations a year. The cocoons are identical with those of the same races which have remained monovoltine, and their silk is of first quality. The eggs hatch regularly 12 or 13 days after they are laid, without its being necessary to subject them to the action of cold which, indeed, appears to be detrimental to them.

As in Europe, diseases are to be feared, especially pebrine; this disease is aggravated in tropical countries by the fact that the generations succeed each other throughout the year without interruption, and also on account of the negligence of the native breeders. The author observed that pebrine is less easily transmitted than is generally believed. He, therefore, made breeding from separated families a strict rule for the production of eggs at the Sericultural Station of Nanisana, near Tananarive. He perfected the method of cellular egg production as practised in Europe: the couples are placed on sheets of paper placed on strips of wood, then covered with a sort of tin funnel to prevent the eggs from mixing and, also, to obtain a large number of eggs in a limited space.

These remarks only apply to *Sericaria mori*, and not to *Borocera madagascariensis*, a native species of very different habits giving a coarse silk.

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

199. — **Tractor Trials in Scotland in 1917.** — *The North British Agriculturalist*, Vol. LXIX, No. 49, p. 740. Edinburgh, December 6, 1916.

The official report of the Reporting Committee of the Highland Agricultural Society of Scotland on the tractor trials held at Edinburgh, Glasgow and Perth, in October, 1917, gives the following classification of the 29 machines that took part in the trials:

1) *Wheels*: 15 ran on 4 wheels; 6 on 3 wheels; 4 ran on caterpillars and 4 were single-unit machines.

2) *Driving*: 18 tractors were handled by 2 men, while 18 were one-man outfits.

3) *Fuel*: 25 were operated by paraffin; 3 by petrol and 1 by steam.

4) *Weight*: 2 weighed over 80 cwt.; 3 over 60 cwt.; 6 over 50 cwt., 7 over 40 cwt.; 3 over 30 cwt.; 8 less than 30 cwt.

(1) See R. August, 1916, No. 891. (Ed.)

The report does not class the tractors in order of merit, but it gives observations that will be of use to both farmers and engineers; these observations are given below.

**WEIGHT.** — Light machines, suitably provided with spuds, grip the ground and perform the work better than the heavier machines. Every drawback, such as slipping in soft land and inability to climb gradients, was aggravated by increase of weight above a certain limit. A heavy tractor is, moreover, at a disadvantage for the lighter forms of cultivation, such as grubbing, cultivating, seeding and harrowing and also for harvesting. The light tractor is quite suitable for all the farm operations, including driving a threshing-mill and other farm machinery. The only class of work for which the light tractor does not appear to be suited is road haulage. The conclusion was reached that, to suit conditions in Scotland, an efficient land tractor need not exceed 30 cwt. in weight.

**HORSE-POWER.** — For various reasons such as inexperienced drivers, loss of power due to soft ground and clogging of the wheels and moving parts with mud, etc., the tractor should have a minimum of 20 b. h.-p., so that it can haul a 2-furrow plough under the worst conditions, and a 3-furrow plough under ordinary conditions; it should also be capable of driving a 4 ft. 6 in. threshing-mill.

**CATERPILLAR VERSUS WHEELS.** — While this arrangement distributes the actual dead weight and thus reduces the intensity of pressure on the land, it appears certain that there must be excessive wear and tear on the caterpillar. As far as the Committee could observe the caterpillar has no advantage as regards gripping power over the best types of wheel machines.

**SPIKES, BARS AND SPUDS.** — A stout spud 3 in. to 4 in. in width and 4 to 5 in. in length appears to be more satisfactory than spikes or bars, especially when these spuds are so arranged in relation to the circumference of the wheel, that the full gripping power of one spud is always in operation.

**ACCESSIBILITY AND PROTECTION.** — The report notes the importance given to rendering the vital parts of the machinery more accessible and also to providing protection against the weather.

**BRAKES.** — For transport purposes, all tractors should be provided with adequate brakes.

**RELIABILITY AND DURABILITY.** — Seeing that only one machine failed to complete the 6 days' work, it seems that a fair degree of reliability has been attained. In spite of the bad state of the ground, the tractors overcame all the difficulties. Two defects were noted as tending to impair durability. These are the exposed gear drives on some of the wheel tractors, which fill with mud and grit, and the already mentioned excessive wear of the caterpillar arrangement.

**SPRING AND OTHER CONNECTIONS.** — The Committee are of the opinion that the drawbar should be provided with some spring appliance, which would relieve the strain on the plough in the case of encountering minor obstacles. With this might be incorporated a release device, which would completely detach the plough under the strain of a heavy shock. This attachment should be an integral part of the tractor and not merely a ca-

sual device inserted in the draft connections. Provision should also be made for altering the point of attachment of the plough to the tractor in a vertical direction. This is important as different implements require different heights of attachment.

**SPEEDS.** — It is suggested that speeds of  $2\frac{1}{2}$  and 4 miles per hour should meet the requirement of a tractor for use on the land.

**FUELS.** — Although no tests of fuel consumption could be carried out, it was found that the carburettors of many of the tractors were not capable of thoroughly and completely vaporising paraffin, and that the combustion was, in consequence, defective in many cases. Under normal conditions, it may be found that petrol is more satisfactory to use than paraffin.

**PLOUGHS.** — They should be made so as to be easily adjusted to varying widths so as to suit the depths and the class of work. Automatic lifting should be provided. They should be provided with a device for regulating the width of the leading furrow.

The Committee further suggest that :

1) If the last unit of the plough could be made so that it could be thrown out of action by being raised with a lever or otherwise, then 2 furrows could be ploughed on an up gradient and 3 on a down.

2) The introduction of a one-way plough would obviate the necessity of having feelers and finishes, most of which, under present circumstances, must be performed with horses.

**HANDLING.** — The handling of the tractors did not appear to present any great difficulties. The single unit machine has the advantage that the implement operation was directly under the observation of the driver. The light tractors and single-unit machines were able to turn more quickly at the headlands.

**PRICE** — The question of price is a difficult one under the present abnormal conditions. Manufacturers should, however, aim at putting a tractor on the market at a price not exceeding £ 300.

200 — **Ploughing and Harrowing with a Tractor.** — RINGELMANN, MAX, in the *Journal d'Agriculture Pratique*, Year LXXXI, Vol CXXXI, New Series, Vol XXX, No 25, pp. 487-489, figs 3 Paris, December 17, 1917.

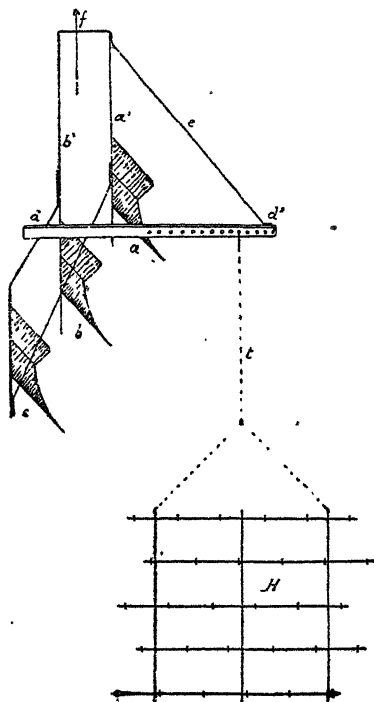
Land ploughed in autumn before sowing and especially spring-ploughed land, should be harrowed as soon as possible. With a tractor, ploughing and harrowing can be carried out simultaneously, by using a simple attachment to the plough.

In the appended figure, giving a diagram of a 3-furrow plough, *a, b, c*, moving in the direction *f*, it will be seen that the harrow *H* can be attached by a chain *t* to a suitable point of a cross bar *dd'*, fixed to the beams *a'* and *b'*. The cross-bar, a 60 mm. beam of wood or iron, is fixed to the beams *a'* and *b'* by bands, and strengthened by a brace-rod *c*. The hook of the chain engages in one of the holes of the cross-bar *d'*, which regulates the width. The position of the chain *t* should be such that the harrow *H* does not work the last earth turned by the plough *c*; the harrow works on the bands *a* and *b*, then the last furrows turned previously; in this way, no earth falls

in the furrow opened by the plough *c*, and thus no interference is caused with the automatic guidance of the tractor.

The harrow should cover a greater width than the plough. After trials with the 20 HP Titan and 20 HP Mogul tractors, excellent results were obtained with the grouping used by the "COMPAGNIE INTERNATIONALE DE MACHINES AGRICOLES"; the 30-tooth harrow, 61 inches wide, was attached to a 3-furrow plough covering 35 inches. According to the depth to which the harrow teeth penetrated, the average extra traction required varied from 374 to 572 lb. The use of a harrow with adjustable teeth, that can be lifted with a lever at the headland, is advisable. The drag-harrow may be replaced by an "Acme" or a disc-harrow. If the tractor is used for harrowing alone, the width of work may be increased by hitching several harrows to a drawbar. In this case, the tractor should not press heavily on the soil, causing packing, and uneven harrowing, with a consequent bad effect on the crop. In the lack of further data on this point, the author thinks that the weight should not be greater than that of 25 kg. per cm. width of tyre.

A harrow frame with seat, joined to the draw-bar, is described which is mostly used in the United States. In 1886 the author had tried such a frame with a seat, built by F. PUZENAT.



Method of coupling a harrow to a 3-furrow plough.

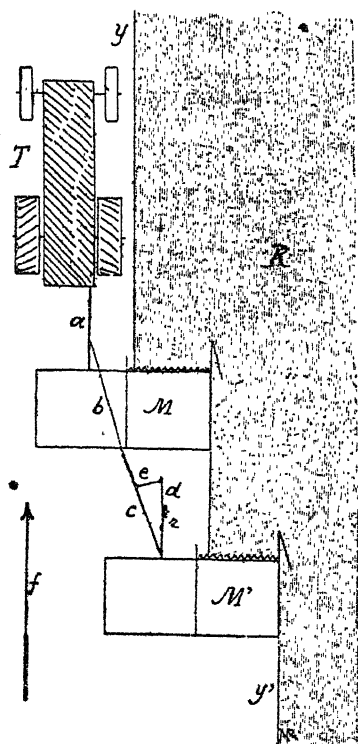
201 - **Harvesting with a Tractor.** — RINGELMANN, MAX.: I. *Journal d'Agriculture pratique*, Year LXXXI, New Series, Vol. XXX, No. 19, pp. 366-368, figs. 3. Paris, Sept. 20, 1917, — II. *Bulletin de la Société d'Encouragement pour l'Industrie Nationale* Year CLVI, Vol. CXXVIII, No. 5, pp. 314-318, figs. 4. Paris, Sept.-Oct., 1917.

I. — Information regarding harvesting with a tractor carried out in 1917 by the "Syndicat de culture mécanique de Sencenac-Puy de Fourche (Dordogne, France), and communicated to the author by M. BIRABEU, of Laborie-Fricard, a managing director of the company.

A 25 HP. Case tractor was used to draw 2 binders with 59 in. cutter-bars. It was estimated that the tractor could have towed 3 binders on flat ground.

The appended figure shows how the machines were attached: the trac-

tor  $T$  moves in the direction shown by the arrow  $f$ , towing 2 binders  $M$  and  $M'$ ;  $R$  is the crop to be cut.  $M$  is attached to the extreme right of the tractor by a small shaft  $a$ , 59 in. long, to which is fixed a towing rod  $b$  receiving a short oblique wooden pole,  $c$ , 79 in. long, whose far end is joined to the base of the shaft  $d$  of the binder  $M'$ . The small shaft  $d$  is supported by a roller  $r$  and forms with  $c$  an angle held by a rod  $e$  acting as a stay. The right-hand driving wheel of the tractor passes at 10 in. distance from the edge  $y$  of the crop  $R$ . The cutter-bar of  $M$  works on its full length, about 55 in., while that of  $M'$  only cuts a width of 49 in. The width cut in each turn (distance between  $y$  and  $y'$ ) is about 102 in.



Plan for coupling 2 binders  
to a tractor.

II. The tractor with the 2 binders, working under the conditions described, burns, on very undulating land, 12.10 gallons of gasoline in 16 hours to cut 15 to 17 acres; the whole assemblage worked for 2 consecutive weeks without stoppage.

With 2 binders attached, the corners of the field should be rounded off on a large area; thus, several machines coupled together would only be suitable for work on large areas. When the width of crop to be cut is about 100 ft., it is more economical to cut only on the 2 long sides, leaving enough space for turning at the ends, removing sheaves that impede the passage.

The author reduces these figures to the rate per hour, using his previous observations made on the 25 HP. Case tractor.

The weight of fuel burned per acre should vary about 4.6 lb., which is not excessive.

Working speed	{ per second . . . . .	35.43 in.
	» hour . . . . .	3546 yd.
Width of cut . . . . .		102 in.
Surface cut . . . . .	{ per second . . . . .	25.29 sq. ft.
	» hour . . . . .	6696 sq. ft.
Actual time worked per hour . . . . .		46 min.
Fuel burned . . . . .	{ per hour . . . . .	1.10 galls.
	» acre . . . . .	0.7 galls.

202 - **The Maillet Field and Vineyard Tilling Machine.** — FRÉMIER, VICTOR, in *Le Génie Rural*, Year X, No. 74, New Series, No. 14, p. 11, fig. 4. Paris, 1917.

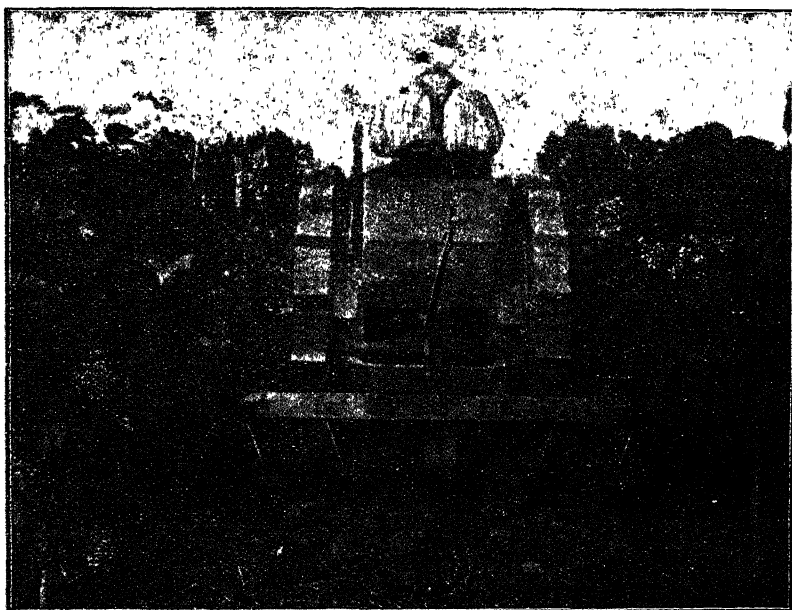
M. MAILLET has changed his single unit tilling machine (1) into an agricultural motor with 2 driving wheels; in addition, he has modified the

(1) See R. Oct., 1916, No. 1111. (Ed.)

vineyard-tilling apparatus. Two types are made, one of 12-15 HP., the other of 20-25 HP.

The small model is more specially designed for use with vines planted 63 to 87 in. apart. Its total length is 102 in., its width 47 in., its height 55 in. The frame, which supports the machinery (enclosed in special gear-boxes), is on 4 wheels, 2 front ones for steering, 2 rear ones for driving. The engine is in front. The gear-box is in the centre and includes 3 super-imposed axles; the central one works the driving wheels through the upper axle. The lower axle drives the tilling apparatus. Three speeds and a reverse are provided for the machine, and 2 or 3 speeds for the tilling apparatus.

This tractor can serve many purposes as it can be used as a tractor for all the ordinary farm vehicles and implements. The appended figure shows the MAILLET tractor working between 2 rows of vines.



MAILLET Field and Vineyard Tilling Machine.

203 - The "Kardell 4 in 1" Tractor. — *The Implement and Machinery Review*, Vol. XXXXIII, No. 512, p. 838, fig. 1. London, December 1, 1917.

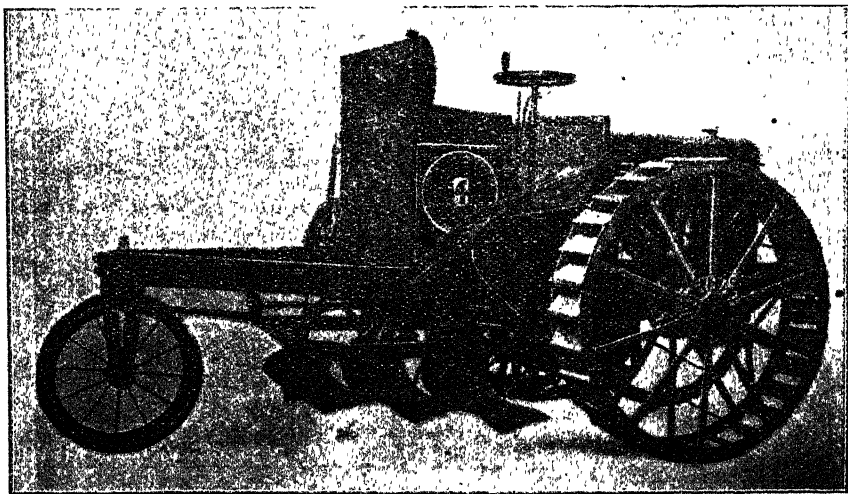
A new tractor built by the KARDELL TRACTOR & TRUCK Co., St. Louis, U. S., A., which can perform 4 different operations: — ploughing, tractor work, motor carting and generating farm power (1).

(1) *The Farm Implement News*, Vol. XXXVIII, No. 6, Chicago, Feb. 8, 1917, gives the following additional information: — weight, 5300 lbs; 4 cylinder engine, working at 900 revs.; 35 HP stated, and 16 HP at draw-bar; fuel, petrol or paraffin; driving wheels; diameter, 60 in.; tyre width, 12 in.; price, \$ 1250. (Ed.)

It is claimed that the tractor meets all the requirements of an average farm of 100 to 500 acres, both for its simplicity of construction and strength and for the multifarious duties it can perform.

As shown in the annexed figure, the 2 driving wheels are of a new type, carrying a webbed tread, tending rather to loosen than pack the soil, and at the same time preventing slipping.

The ploughs are carried under the main frame, an arrangement which is said to reduce the draft by 33.3 per cent. Three 14-in ploughs are attached to an adjustable spring draw-bar, which automatically stops the ploughing when a rock or stump is encountered. The ploughs are so regulated that they individually follow the contour of the ground, and secure an even depth under all conditions. It is claimed that from 12 to 15 acres a day can be ploughed. The machine can be driven in either direction with ease. The ploughs can be easily removed, and the tractor used as a tractor or truck. A 20-in pulley is provided for driving stationary machinery.



"Kardell 4 in 1" Tractor.

204 - **The "Eros" Tractor Plough.** — *The Implement and Machinery Review*, Vol XLIII No. 512, p. 831, 1 fig. London, December, 1, 1916

The "Eros", manufactured by J. M. B. COLLINS, of Bacton, Norfolk, England, is a self-lift 3-furrow plough, which can be easily converted into a 2-furrow implement.

One of its most noteworthy features is a patent automatic lifting device, which utilises the forward movement of the tractor, instead of using springs. By merely pulling a cord, a small catch is released and the lifting gear automatically comes into action, lifting the plough out of the furrow when at the headland. By turning a small handle the depth of ploughing can be regulated while the plough is at work. It turns a furrow  $9\frac{1}{2}$  in wide and from 8 to 9 in. deep.

[~~insert~~]



The frame is of flat steel, strongly riveted to withstand the strain of tractor work. The total weight of the plough is about 6 cwt.

205 - **The W. A. Wood Motor-driven Binder.** — *The Implement and Machinery Review*, Vol. XLIII, No. 512, pp. 835-836, figs. 3. London, Dec. 1, 1907.

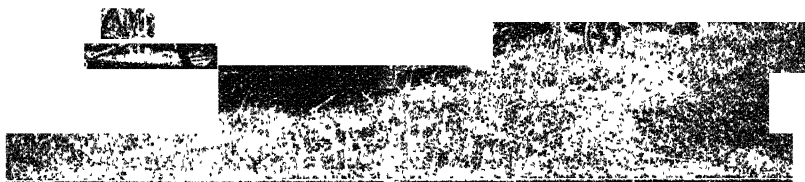


Fig. I. — The W. A. Wood binder with a Wood motor mounted in the rear.

In the United States, motor-driven binders are more freely used than in England. During the 1917 season, binders so equipped did excellent work in Scotland. Fig. I shows a WALTER A. WOOD binder equipped with a Wood petrol engine.

Owing to the engine, the crop is cut more easily, especially in the case of tangled crops; the draught is also lightened, for only 2 horses are required instead of 4; moreover, the work is performed in  $\frac{2}{3}$  of the time required for an ordinary binder.

Mr. J. FERRIER, of Wick, using this machine, cut 97 acres of oat and barley in 100 hours, using only 32 gallons of petrol. Fig. 2 shows the 4 H. P. WOOD engine, which can be fixed on the rear of the binder. The engine can also be used to drive any binder, potato digger

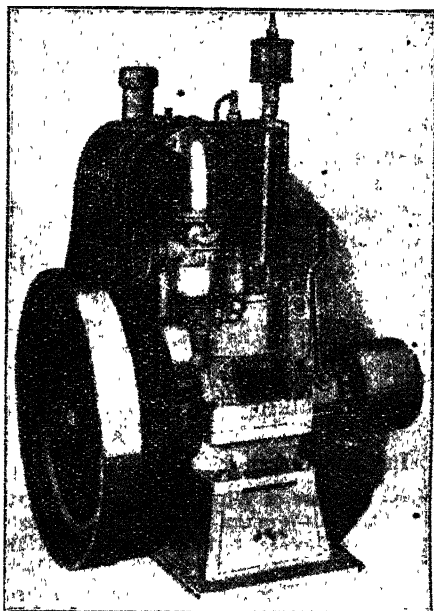


Fig. II. — WOOD motor.

or manure spreader. When mounted on a special base, it can be used for running chaff cutters, mills, circular saws, pumps, etc.

206 - **The "Balbo-Bertone" Motor Rice-Harvester.** — TARCHETTI, A., in *Il Giornale di Riscoltura*, Year VII, No. 19-20, pp. 243-247, 2 fig. Vercelli, October 15-30, 1917.

The BALBO-BERTONE side-delivery reaper is an ordinary ADRIANCE machine of which the rakes and the knife-bar are worked by an 8 HP. Felix benzol-burning engine, of Swiss make.

The machine is easily drawn by a pair of horses or oxen, the presence of the engine permitting the ordinary driving wheel of the harvester to be replaced by a lighter wheel of wood (diameter 33 in., tyre 6 in. wide and 4 in. thick) which only carries the weight. In damp and soft soils, a sledge or skate supports the machine when the tyre sinks in the ground. This sledge or skate is 6 ft. 6 in long and placed near the wheel, nearly at the centre of gravity of the machine, so that it will slip along over the mud. Being attached almost rigidly to the beam, the skate can easily pass over dikes and ditches.

The sledge or skate, made of hollow sheet-iron, 6 in. wide, is suspended from the axle by two buffer-springs to deaden shocks against the ground. It also serves as a water-tank for the engine, an ingenious arrangement that saves space and lowers the centre of gravity, which makes the machine more stable and gives rapid cooling against the damp soil of the rice-field.

At the other end of the machine, under the knife-platform is another small spring-mounted skid, near the wheel carrying the platform, the height of which can be easily adjusted according to the height of the cut.

The knife-blade is 59 in. long ; there are 4 rakes, which can work together or in part as beaters. The engine has 1 cylinder and moves the knife-bar to and fro about 250 times a minute.

Without the driver the total weight of machine with the tank full is about 1320 lbs., while the ordinary ADRIANCE No. 6 harvester weighs 940 lbs. The BALBO-BERTONE harvester is 10 ft. 6 in. wide when working and 62 in. when folded up for moving on the road. Its pre-war price was £ 100.

Trials with this machine have been carried out in both a transplanted and an ordinary rice field. It was drawn by 2 oxen lead by a driver ; a mechanic, attending to the engine and the machine, was seated. Except for the unexpected breakage of a gear during the last hour of the experiment, the harvester worked regularly, cutting cleanly, completely and evenly ; the sledge worked very well, the rakes were efficient and the work was not too heavy for the oxen. Before using the harvester, an opening of about a yard should be cut in the rice with a scythe to allow for turning. With the oxen walking at 31.49 in. per second, and the width of cut being 51 in., some 4 425 sq. yds. may be harvested per hour, about 1.5 to 1.8 lb. of benzol being consumed.

207 - **The Use of Wind Engines for Irrigating Semiarid Soils in the Western United States.** — FULLER, in *U. S. Department of Agriculture, Farmers' Bulletin* 866, pp. 38, figs. 11, tables 8, bibliography of 32 Bulletins concerning Irrigation. Washington, 1917.

This bulletin is a new and revised edition of bulletin 394, published in 1910 by the U. S. Department of Agriculture, with the object of showing

how to irrigate small tracts of land cultivated without irrigation by means of wind engines. Information is given as to: — sources of water; boring hydraulic wells; power required to lift water; friction of water in pipes; method for calculating the dimensions of the wind engine to be bought.

To choose such an engine, a Meteorological Bureau should be consulted as to the wind velocity over a considerable period of time. The velocity of the wind is neither constant nor regular, and may vary from 10 to 25 miles per hour in a few minutes.

Ordinary methods for ascertaining the velocity of the wind do not take these fluctuations into account, usually only indicating the average velocity. In choosing a wind engine and pump, the average velocity per hour should be neglected, attention being paid to the time during which the wind attains certain velocities per hour.

Attention should be paid to: — 1) the provision of efficient lubrication; 2) easy renewal of worn parts; 3) strong and accurate construction of the engine and its parts; 4) the reputation of the engine under consideration. Useful information is given regarding the tower, its bracing, anchoring, and construction as well as the care of the wind engine. In 2 tables, applying particularly to Kansas, Colorado, and Nebraska, the author has summarised information obtained by observing and inspecting numerous wind engines, relating to: 1) the area to be irrigated; 2) the crop grown; 3) the number of trees planted; 4) the dimensions of the wind engine; 5) the capacity of reservoirs, the construction and design of which are considered in detail. Circular tanks are the most easy to build, and have fewer disadvantages. A table gives the cost of constructing circular reservoirs of suitable dimensions and capacity for the land to be irrigated.

208 - **The Marcel Landrin Non-Slip Wheel.** — RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXI, Vol. CXXVIII, No. 5, p. 311-212, figs. 2. Paris, September-October, 1917.

The driving wheels of the MARCEL LANDRIN winch tractor (1) are of the type called "non-slip", the strakes of which, placed obliquely to the spokes, pass through openings in the tyres of the driving wheels. The strakes turn round an eccentric on the axle of the wheels and, according to the position of the eccentric, the strakes protrude at the lower part of the wheel to penetrate in the soil when the machine is working in the field as a tractor, or else protrude on the upper part when the machine is travelling on the road.

209 - **Industrial Alcohol in South Africa.** — *The South African Journal of Industries*, Vol. I, No. 1, pp. 46-48. Pretoria, September, 1917.

The question of producing alcohol as a substitute for petrol as a motor fuel has long engaged the attention of the South African trade. For this purpose many products capable of yielding alcohol were examined — maize,

(1) See *B.* 1914, No. 557. — The *Notes de Culture Mécanique* by Dr. CHAUVÉAU (Paris, Librairie Baillière, 1917) gives the following data as regards this tractor: — Weight 11 000 lbs; 4 cylinder engine of 140 mm. bore and 150 mm. stroke, running at 800 revolutions per minute; 45 HP.; fuel: petrol, alcohol, or paraffin; dimensions: 15 ft. 9 in. X 7 ft. 4 in. X 6 ft. 1 in.; 2 front wheels and 2 driving wheels. (Ed.)

potatoes, prickly pear and cane sugar molasses — but, except in the case of the latter, no definite results have been obtained. In the molasses of the Natal sugar plantations the Union has a source of supply capable of producing an inexpensive alcohol. Up to the present, production on a commercial scale was impossible, owing to the 2 s. per gallon duty. In order to encourage the production of an alcohol to be used as fuel, the Union Government removed this duty on the condition that a satisfactory denaturant be found.

The law demands that 100 volumes of such alcohol shall contain not less than 2 volumes of wood naphtha, and at least  $\frac{1}{2}$  volume of pyridine bases; if the alcohol be mixed with ether, then 1 volume of wood naphtha or benzine shall suffice for every 10 volumes of ether present.

The alcohol shall be coloured blue, green, or violet, with a stable colouring matter. The intensity of the colouration which will be accepted as sufficient is not less than that of a 5 % solution of crystallised copper sulphate.

## 210 — Review of Patents.

### *Tillage Machines and Implements.*

France	480 424 (20 256) Soil tilling implement (1).
	480 942 (20 399) TOURAND and DERGUESSB motorplough (2).
	485 097. New rack regulating system for ploughs.
Switzerland	76 514. Motor balance-plough.
United-Kingdom	110 032. One way motorplough.
	110 198. Motor driven cultivating implement.
United States	1 244 714 Combined colter and jointer.
	1 244 838. Implement frame.
	1 244 993 — 1 245 261. Harrows.
	1 245 295. Double disc harrow.
	1 245 613. Cultivator.

### *Irrigation.*

United States	1 245 050. Irrigating apparatus.
	1 245 271. Irrigation ditch cleaner.

### *Drills and Seeding Machines.*

United Kingdom	110 094. Potato planter.
United States	1 244 787. Seed discharging mechanism.
	1 244 957. Maize planter.

### *Various Cultural Operations.*

Switzerland	76 766. Drill cultivator.
United States	1 241 531. Weeder and cultivator.
	1 244 765. Hoe.
	1 244 850. Wheel hoe.
	1 244 954. Banana protector.
	1 244 982. Rotary weeder.
	1 245 252. Combined earth disintegrating and weeding machine.
	1 245 541. Plant protector.

(1) See R. January 1917, No. 79. — (2) See R. February 1917, No. 181. (Ed.)

*Control of Diseases and Pests of Plants.*

- Canada 178 969. Animal trap.  
 France 484 812. Driving device for sprayers and dusters, using the movement of the draft animal.  
 United States 1 244 547. Boll-weevil trap.  
 1 244 563. Animal trap.  
 1 244 646. Weed cutting machine.  
 1 244 834. Insect destroyer.  
 1 245 258. Insect catcher.  
 1 245 706. Insect gathering and killing machine.  
 1 245 920. Weed puller.

*Reapers, Mowers and Harvesting Machines.*

- Canada 178 924. Stooker.  
 United States 1 244 789. Rake.  
 1 244 458. Ensilage harvester and cutter.  
 1 245 565. Gearing for peanut harvester.

*Machines for Lifting Root Crops.*

- Canada 178 935. Potato digger.  
 United States 1 245 526. Potato harvester.

*Winnowing Machines.*

- Canada 178 679. Grain grader and cleaner.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Canada 178 704. Hay stacker.  
 Netherlands 2 197. Fruit sorting apparatus.  
 Switzerland 76 515 Press for grapes and other fruits.  
 76 767. Fruit crushing machine.  
 United Kingdom 110 108. Maturing fruit apparatus.  
 United States 1 244 513 — 1 244 514 — 1 244 515 — 1 244 516 — 1 244 517. Grinding burs.

*Steering and Traction of Agricultural Machinery.*

- United States 1 244 727. Means for converting automobiles into trucks.  
 1 245 001. Tractor belt.  
 1 245 566 — 1 245 715 — 1 245 896. Tractors.  
 1 245 708. Controlling device for traction vehicles.

*Feeding and Housing of Livestock.*

- United States 1 244 847. Cattle food and process of making same.  
 1 245 032. Horse shoe.

*Poultry Farming.*

- United Kingdom 110 124. Rearing poultry.  
 United States 1 245 041. Brooder.  
 1 245 159. Poultry roost.

*Dairying.*

- Canada 178 844. Centrifugal separator mechanism.  
 Switzerland 76 554. Churn motion mechanism.  
 76 799 — 76 800 — 76 801. Churns.  
 United States 1 245 106. Milking machine.

*Farm Buildings.*

- Canada 178 726. Post hole auger.  
 United States 1 246 008. Wind mill.

*Various.*

- United States 1 245 381. Oil can.

## RURAL ECONOMICS.

211 - Value to Farm Families in the United States of Food, Fuel and Use of House. — FUNCK, W. C., in *U. S. Department of Agriculture, Bulletin No. 410* (Office of Farm Management), pp. 1-36. Washington, D. C., November, 1917.

The scope of this survey was to determine the value of those things which the farm furnishes to the farm family without money cost, namely the use of a house, food and fuel. The data were secured from nearly 1000 families, representing widely separated sections in 14 States. Figures were gathered covering the value of all food, fuel and shelter, itemized to show what part was bought and what part was furnished by the farm. Data also were collected bearing on the value of household labour on the farm.

Following is a brief abstract of the more significant averages established by this inquiry. The figures given are based on reports from 950 families, averaging 4.8 persons per family.

*Annual value of food, fuel, and use of house : —*

Average per family, \$ 642	Furnished by farm. . . \$ 424		(66 per cent.)
	Bought . . . . .		218 (34 per cent.)

*Annual value of food : —*

Average per family, \$ 448	Animal products	58 per cent.	From farm 58 % Bought . . 42 %
	Groceries . . .	25 " "	
	Vegetables. . .	11 " "	
	Fruits. . . . .	6 " "	

*Annual value of fuel : —*

Average per family, \$ 62	Wood (9.4 cords). .	\$36.30	From farm 54 % Bought . . 46 %
	Coal (2.6 tons). . .	17.85	
	Oil (55 gallons). . .	6.33	

*Annual value of use of house : —*

Average per family, \$ 132.

*Annual value of housework : —*

Average per family, \$ 228	Furnished by family \$ 217 (95 %)	
	Hired . . . . .	

It was found that the average annual value of meats (other than poultry) consumed per family was \$ 107.25 ; of poultry products, \$ 55.40 ; and of dairy products \$ 98.36. (The quantity of dairy products consumed was equivalent to 2 640 quarts of milk).

Meats constitute the most important group of foods. As it increases relative to the other groups the total value of food consumed per family increases.

Those families having a relatively greater consumption of either gro-

ceries, vegetables, or dairy products use relatively less meats, and their total consumption of food is less in value.

Families living on their own farms reported higher consumption of food and a larger proportion of food derived directly from the farm than did those living on rented farms. The average quantity of fruit canned annually per family was 122 quarts; of vegetables 32 quarts. The cost of board (as of hired hands) in food, fuel and house work, was shown to be \$ 129 per year. Thirty-one per cent of this represents cash outlay.

The survey includes the following counties and States: Oxford, Me., Lamoille, Vt., Otsego, N. Y., Bucks, Pa., Gloucester, N. J., Gaston, N. C., Troup, Ga., Mc Lennan, Tex., Champaign, Ohio, Jefferson, Wis., Montgomery, Iowa, Cloud, Kans., Cass, N. Dak., Santa Clara, Cal.

## AGRICULTURAL INDUSTRIES.

212 - **The Composition of the Fixed Acidity of Sound and Diseased Wines.** — LABORDE, J., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 25, pp. 1017-1020. Paris, December 27, 1917.

The fixed acidity of wines is the difference between the total acidity and the volatile acidity. It is of interest to know the proportions of the various fixed acids in the results obtained by the determination of the acids as a whole. This may be done fairly exactly by the author's new analytical method (1) which divided fixed acidity into two principal parts: — 1) acidity soluble in ether-alcohol, due to lactic, succinic, malic and citric acids; 2) insoluble acidity, including tartaric acid as cream of tartar and a slight additional acidity.

The author found lactic acid present in marked quantities in the wines he studied, even in those which had not been influenced by filiform ferments. The proportion of succinic acid does not vary much, whereas the figures for malic acid differ greatly, sometimes exceeding those for tartaric acid. Citric acid is sometimes present in fairly large quantities.

Anaerobic microorganisms, which cause the more or less serious diseases of wine, may cause the fixed acidity to vary considerably.

When wine turns sour, the tartaric and malic acids disappear fairly quickly, the one more completely than the other, whereas they remain more or less in bitter wine. This difference also depends doubtless on the initial composition of the wine as well as on the bacterial action; but, on the other hand, the ferments of sour wine being more active than those of bitter wine, it is possible that this action is on the lactic acid formed at the beginning, when tartaric and malic acids are absent in sour wine. Succinic acid appears to resist the influence of all ferments causing disease.

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(1) *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 23, p. 793-795. (Author).

213 - Contribution to the Study of Alcoholic Ferments. — KAYSER, E., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 25, pp. 1020-1022. Paris, December 17, 1917.

Selected yeasts often have a great influence on the quality of fermented drinks. They also play a part in the secondary reactions, especially if left on the lees for a certain time; in the alcohols obtained there are distinct differences in the various components of the non-alcoholic coefficient.

At the end of a year an analysis of the fermentation products gave the following results:—

	Quantity per litre					
	wine yeast		cider yeast		perry yeast	
	1	1 a	2	2 a	3	3 a
Total acidity in malic acid . . .	5.84	10.92	6.47	10.54	6.99	10.92
Volatile acidity in acetic acid . .	0.142	0.071	0.368	0.110	0.052	0.065
Alcohol per cent in volume . . .	6.93	6.20	6.85	6.30	6.87	6.32

The same apple must, obtained from equal weights of the varieties Saulet, Lauquart, Cébin and Douce de Bretagne, was compared by adding to it a wine yeast (Champagne), a cider yeast (Cálvados) and a perry yeast (Eure). Fermentation took place in six flasks, to three of which (the three a) was added a sterile solution of ammonium phosphate.

The volatile acidity was composed of acetic acid and butyric acid with traces of formic acid. The addition of phosphate decreased the proportion of volatile acids. The proportion of butyric acid was higher for perry yeast, and especially for wine yeast, than for that of cider, *i. e.*, the phosphate increased the proportion of acids superior to acetic acid. It is known that phosphate also increases the amount of yeast.

The alcohols were redistilled and concentrated; their composition was found to be as follows:—

	Percentage of alcohol at 100°, in milligrams					
	1	1 bis	2	2 bis	3	3 bis
Volatile acidity in acetic acid . .	17.3	16.7	31.1	21.3	17.1	17.0
Aldehydes . . . . .	323.2	64.4	330.0	247.0	349.0	315.0
Furfural . . . . .	0.15	0.32	0.15	0.12	0.11	0.11
Ethers, as ethyl acetate . . . .	50.8	49.3	47.9	67.3	43.4	67.1
Higher alcohols . . . . .	364.0	245.0	167.0	153.0	213.0	159.5
Non alcohol coefficient . . . . .	755.45	375.62	576.15	488.72	667.61	559.61

It is seen that the three yeasts are distinctly different. In spite of slight contact with the air all produced much aldehyde; the addition of



phosphate decreased their proportion, especially for wine yeast. The ethers are present in small quantities as opposed to the aldehydes, but, in the case of cider and perry yeasts, were increased by the addition of phosphate. Wine yeast gave most higher alcohols, cider yeast the least; phosphate decreased them.

The impurities are, therefore, greatest for wine yeast, showing that a selected yeast, chosen in accordance with the aim in view, might be more advantageously used. Such yeasts must be used with a knowledge of their properties; among the various yeasts of wine and cider, there are doubtless some which would have acted differently from those used in the author's experiments without bringing in the important factor of custom.

214 - Contribution to the Study of the Alcohols of Cider (1). — KAYSER, E., in *Bulletin de la Société des Agriculteurs de France*, pp. 321-323. Paris, November, 1917.

In 1916 the author reported that high temperature increased the proportion of volatile acids, aldehydes, ethers, and higher alcohols in alcoholic fermentation. In this paper he describes his studies on the influence of the must, especially of its nitrogen content, on the formation of these substances.

Apple must, sterilised in the autoclave, and containing 10.4 % of saccharose, was subjected to fermentation. At the beginning of December, 1916, this was sprinkled with a strong yeast *a* and an apiculated cider yeast *c*. The experiments were made in three flasks which, when sprinkled with the yeast, were left in a cupboard at room temperature, which varied from 4 to 12° C. They were, thus, subjected to all the variations of the winter 1916-1917. Fermentation was slow.

In March 1916, *i. e.* 3 ½ months later, the liquid in the two flasks *A* and *C* was poured into two similar flasks. The operation was carried out aseptically, and care was taken not to disturb the lees at the bottom. The liquids were analysed (enough for this purpose remained at the bottom of the flasks, on the lees).

The contents of flask *A* were poured into an empty, sterile flask, *A'*; those of flask *C* into a flask, *C'*, which contained the same must fermented by a third yeast, *b*.

The experiment was continued: — Flask *A*, without yeast, flask *B* with lees formed from the beginning, flask *C* in contact with a new yeast which had still to finish its secondary fermentation.

In spite of the precautions taken during pouring, a few globules of the yeast *a* passed into the flasks *A'* and *C'*.

The experiment was interrupted after 6 months, *i. e.* towards the middle of June and the fermented liquids analysed. Corresponding alcohols were obtained by heating. Table I (on the following page) gives the results obtained.

These results show that fermentation was not quite identical, at the same moment, in the three flasks, although all the conditions were the same. This is often observed in laboratory experiments.

(1) See *R.*, December, 1916, No. 1320. (*Ed.*).

TABLE I. — *Results of analysis of the fermented liquids (per litre).*

	After 3 ½ months		After 6 months		
	A	C	A'	B	C'
Total acidity (sulphuric acid) . .	2.48 gm.	2.29 gm.	2.75 gm.	2.71 gm.	2.73 gm.
Volatile acidity (acetic acid) . .	0.598 gm.	0.501 gm.	9.678 gm.	0.534 gm.	0.427 gm.
Alcohol % in volume . . . . .	4.60	4.200	6.200	6.500	5.700
Reducing matter. . . . .	20 gm.	31.1 gm.	9 gm.	4 gm.	22 gm.

It should be noted, in particular, that the quantity of volatile acids has decreased for *C'* between the first and second analyses. It should also be noted that after 3 months of this slow fermentation, on account of the temperature, there still remained some undecomposed sugar, present in a larger proportion in *C* than in *A*, and that, even after 6 months, in spite of the presence of an active, re-invigorated yeast, there was still a good proportion of reducing matter per litre.

TABLE II. — *Analysis of the alcohols obtained.*

	Quantity per cent of alcohol at 100° in milligrams		
	A'	B	C'
Volatile acids (acetic acid) . . . . .	94	51	46
Aldehydes . . . . .	69	8.40	57.6
Furfural . . . . .	0.6	0.32	0.44
Ethers (ethyl acetate) . . . . .	89	97	110
Higher alcohols . . . . .	55.3	44.5	68.50
Non alcohol coefficient . . . . .	307.9	201.22	282.54

Table II shows that flask *B*. is the poorest in higher alcohols and aldehydes. It seems, thus, that decanting, which facilitated aeration, increases the content in higher alcohols and the formation of aldehydes. Decanting on to a new yeast decreased the volatile acidity and increased the ethers.

The non-alcohol coefficient, *i. e.* the total amount of impurities, is highest in flask *A'*, from which the lees were most carefully removed. All the non-alcohol coefficients are inferior to those obtained in practice with impure fermentations; this is not surprising.

Below are the usual ratios obtained from the study of the alcohols.

Flask	Ethers Acids	Ethers Higher alcohols	Total Alcohols + Ethers
A'	0.94	1.6	144.3
B	1.9	2.2	141.5
C'	2.3	1.6	178.5

The ratio  $\frac{\text{ethers}}{\text{acids}}$  increases from  $A'$  to  $C'$  because the volatile acids decrease without there being a proportionate increase in ethers. The proportion  $\frac{\text{ethers}}{\text{alcohols}}$  is the same for the flasks  $A'$  and  $C'$ , being higher for the undecanted flask, which has a lower content of higher alcohols.

The total "alcohols + ethers" is highest in the flask  $C'$ , where the secondary fermentation was made with a new yeast. It is thus possible to see the influence of the new yeast, as well as that of an almost complete absence of yeast, in other words, the effect produced by decanting flasks  $A$  and  $C$ .

There is no doubt that in practice the results would have been similar, with, perhaps, less marked differences.

These experiments show also that cider for drinking and cider for distilling must be treated differently. It is clearly not a question of diseased ciders, with which frequently the only thing to be done is to turn them into alcohol. It is also probable that the variety of yeast is of great importance from this point of view.

215 - **The Production of War Alcohol with Perry Pears.** — TRUELLE, A., in *Comptes rendus de Séances de l'Académie d'Agriculture de France*, Vol. III, No. 31, pp. 913-924. Paris, October 17, 1917.

Most of the early and semi-early perry pears become over-ripe very quickly. It is, therefore, necessary, to make the best use of them, to apply a rational treatment which will delay over-ripening as long as possible — storage at a low temperature by piling in well-ventilated lofts, or better still, spreading in the open air on faggots in a shed or under a roof sheltering them from the rain and sun. The piles must not exceed a height of  $19\frac{1}{2}$  to  $24\frac{1}{2}$  inches. The fruit must, moreover, be very carefully watched so as to note when it begins to turn sleepy, so that it may be used, at the latest, before the endocarp is attacked.

The best use of sleepy pears is to turn them into alcohol, but this can only be done by means of suitable treatment of the fruit and juice. It is particularly important that the clear juice ferment rapidly and completely by the use of leaven or pomase prepared with native yeasts, or selected yeasts.

To obtain a clear juice the sleepy pears must be pressed in separate layers, not more than 4 to 6 inches thick, inclosed, if possible, between thick canvas and separated one from the other by draining-hurdles, or, in the absence of canvas and hurdles, by beds of long straw, or very clean reeds. If, after the first pressing, the residue contains many fragments of pulp, it is crushed; otherwise it is crumbled and pressed again; in no case is it diluted with water. The two juices obtained are put in a very clean, unfumigated cask and sprinkled as soon as possible.

The leaven is prepared with two leavens, 20 to 30 litres of mother leaven, and about 100 litres of a stock leaven; it is this latter which is finally added, the first being used to prepare it. : —

The technique of the method used by brewers to prepare the leaven is

described and emphasis is given to the necessity of distilling so as to produce the greatest quantity of well flavoured alcohol of the highest quality. The most reliable method of succeeding is to use a rectifying still, giving alcohols of 60° to 75° passing over first,

The author comes to the following conclusions : —

From a chemical point of view, sleepy pears contain less sugar, tannin and acid than sound pears, but more pectic matter. From an economic point of view, considering only two important factors influencing their value — gross weight and sugar — during over-ripening they lose much weight the loss varying, according to the variety and duration of over-ripening, between  $\frac{1}{11}$  and  $\frac{1}{5}$  of their total weight, and between about  $\frac{1}{3}$  and  $\frac{2}{5}$  of their total sugar content. Such a loss, expressed in 100° alcohol, is equal, in round figures, to a deficit of from 7 to 25 litres per metric ton of sound pears.

Under present conditions, so as to lose nothing which may be of use to the national defence, every grower should turn his sleepy pears into alcohol. This is, nevertheless, only a means of avoiding total loss as, otherwise, such pears have no commercial value, but it is of far greater importance to use them while they are sound as then they yield a better and more abundant product.

216 — **On Chalk Bread.** — LEPICQUE, L. and LEGENDRE, R., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXX, No. 19, pp. 896-897. Paris, December 8, 1917.

With reference to M. RAPHAEL DUBOIS' note (1) in which he proposes to add to coarsely bolted flours used in breadmaking calcium carbonate instead of caustic lime water which he said "kills the yeast", the authors state that, in their opinion, caustic lime is preferable.

Lime water, they say, does not kill the yeast, save when mixed with it directly before it is added to the dough. If, however, the amount of alkali is so calculated as to neutralise the flour incompletely, the lime method gives the dough a slightly acid reaction which appears to be the optimum condition for the yeast, whereas the acid fermentations are inhibited by a preceding decrease of acidity. When the leaven only is used there is no danger, with lime water, of exceeding the point of neutralisation. If the leaven is strengthened by the addition of grain yeast, it is sufficient to dilute this yeast in tap water; it is then added to the dough, from which the alkalinity of the lime has disappeared.

The difference between the quantities of chemical product added is: — with lime water, a maximum of 30 cgms. per kilogram (2.2 lbs.) of bread; with calcium carbonate, 15 to 20 gms.; even if reduced by half this last proportion will doubtless appear excessive for a food such as bread.

217. — **Milling and Baking Tests of the New Wheat "Kanred",** in Kansas, U. S. A.

— See No. 159 of this *Review*.

(1) See R. January, 1918, No. 3. (Ed)

218 - **The Cotton Industry in China.** — From the "North China Herald" in *The Agricultural Journal of India*, Vol. XII, Part IV, pp. 658-661, Calcutta, October, 1917.

China's importations of cotton from foreign countries are increasing and will continue to increase, because the finer yarns cannot be spun from Chinese cotton. Shensi cotton, which is an American strain introduced into China, is about the only Chinese cotton that can produce a finer yarn than 16's and at the same time obtain a satisfactory production; and what China needs is more cotton of the Shensi type, or finer.

China's export cotton trade is a considerable one and about half of the exported cotton goes to Japan.

There is a special grade of cotton peculiar to Shantung in much demand in America, where it is prepared as medicated cotton, for which it is especially adapted, as it is so white that it requires no bleaching. It is a short fibre and harsh to the touch, so it makes an admirable imitation wool, either when used alone or mixed with wool in the manufacture of cheap hosiery and underwear.

Considering the remarkable growth of the local spinning and weaving industry during very recent years, it is only reasonable to expect that the future will see Shanghai developed into the Manchester of the Far East, provided, however, that the manufacturers are given reasonable protection so that they may be allowed to compete on a fair level with foreign mills. Given this protection, the possibilities for expansion seem almost unlimited, when it is considered that all of China's millions are clad in cotton clothing. That there is ample room for vast increase in the number of power-driven spindles and looms, may be judged from the following estimated figures for the three Far Eastern countries, interested in cotton mills:

	Population	Spindles	Looms
China . . . . .	400 000 000	1 050 000	5 000
India . . . . .	278 000 000	6 400 000	28 000
Japan . . . . .	52 000 000	2 414 544	24 000

Japan, a non-cotton growing country, has succeeded in developing the mill industry to such an extent in 25 years, through a protective tariff, which places raw cotton on the free list and heavily taxes manufactured cotton when imported.

Modern cotton manufacturing was introduced into China in 1890 and was extended considerably in 1896 and 1897, when foreign capital was put into local mills. Up to 1902, however, there were no returns on the investments, owing to the rapid increase of spindles and the inefficient supply of native cotton, which was not equal to the demand, and the fact that the price of raw cotton, because of the shortage, increased out of proportion to the price of yarn. The demand for the raw material, however, was met by increased acreage, and the mills have been more prosperous during recent years.

Since the organization of the Shanghai Cotton Testing House in 1911, the testing of cotton against water and other adulteration has led to very beneficial results during the past few years. The associated mills, under the

rules of the House, are not allowed to accept cotton carrying over 15 per cent. water, and an effort is being made to keep the moisture down to 12 per cent.; the natural moisture carried by American cotton is 8 per cent., and in China commonly it is 10 per cent. although Shensi cotton is naturally so low as 9 per cent.

China grows cotton and exports half to Japan, whence it is returned in the form of yarn and cloth which could be made in China. When the mills in Shanghai use Shensi, Shantung, Hupeh, or other cotton not grown in this province, at the port of entry the customs levy a duty of HK. Tls. 0.35 per picul (1), and again HK. Tls. 0.175 per picul import duty at Shanghai, in all HK. Tls. 0.525. The mills naturally avoid, so far as possible, using cotton from other than their own districts, with the result that a large part of the crop raised in provinces not adjacent to Shanghai is exported and returned to China in manufactured goods. The demand for foreign cotton, which is indispensable for certain purposes, is increasing annually, but the duty the mills have to pay on the imported cotton constitutes a considerable obstacle to the further development of the industry.

219. — **Paper Making with Ailanthus Wood.** — See No. 170 of this *Review*.

220. — **Industrial Uses of Sweet Sorghum (Coloring Matter from the Glumes, etc.).**

— See No. 172 of this *Review*.

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221. — **Investigations into the Proteolytic Activity of Lactic Ferments (2): — III. The Influence of the Method of Milk Sterilisation; IV. Lacto-culture in the Selection of Lactic-Proteolytic Ferments.** — GORINI, COSTANTINO, in *Atti della Reale Accademia dei Lincei, Ser. V, Rendiconti di Scienze fisiche, matematiche e naturali*, Vol. XXVI, Pt. 7 and 8, pp. 195-199 and 223-227. Rome, 1917.

The increasing importance of lactic ferments, not only in agriculture (cheese industry, silage), but also in medicine (surgical and intestinal infections) should induce workers to continue to study the differentiation and selection of species best adapted to particular functions and to cultivate them so as to obtain the greatest possible benefit.

As the author showed long since, the lactic ferments differ less in their morphological characters than in their bio-chemistry, so that one ferment cannot be used indifferently for another in cheese making or ensiling fodder.

Apart from their acidifying capacity lactic ferments also possess another very interesting faculty — their proteolytic activity, to which the author has already drawn attention by pointing out its scientific and practical-importance for either the ripening of cheese or silage or for intestinal bacteriotherapy. The proteolytic activity of lactic ferments has been largely misinterpreted as a result of unsuitable experimental conditions. Since the author has made known the inhibitory influence exercised on this activity under such conditions (especially the incubation temperature and

(1) The Hai-Kwan-Tael of the Customs weighs 37.72 grams and had in 1913 an average value of 3.81 fr. A Pikul of 100 chin is equal to 60.453 kg. (Ed.)

(2) See also R., Jan., 1916, No. 109; R., Feb. 1916, No. 232 (Ed.)

the nature of the culture medium), other workers have modified and rectified their opinions, and types of lactic ferments formerly considered to have no peptonising power are now acknowledged to possess it.

Another source of error which must be eliminated is the excessive temperatures generally used when sterilising milk for lactic ferment cultures, as these turn the milk brown and affect the casein. Milk sterilised too long or at excessive temperatures is not suited to the casein-peptonising action of lactic ferments. (This is probably one of the motives causing workers to disagree with the author as to the importance of certain bacteria of cheese, the udder, etc.).

To make an exact study of the biochemistry of lactic ferments the milk must be sterilised with precautions which, as far as possible, will enable it to keep its white colour. This result may be obtained with an autoclave, or, better still, a current of steam, at a temperature not exceeding 100° C. and by fractional sterilisation for 1 to 20 minutes during 3 consecutive days. It would be preferable to use temperatures below 100° C., but in this case the milk must be taken aseptically. In all cases the sterilised white milk must be carefully examined to make sure it is free from microorganisms.

Only when, by the improved cultural technique devised by the author, it has been possible to separate and set in motion the proteolytic capacity of a given lactic ferment, will it be possible to differentiate this ferment, and for the selector to appreciate and utilise it either in agriculture or medicine, where, not only the acidifying capacity, but also the products of proteolysis (albuminoids, peptones, amino-acids) of the ferments used must be taken into consideration.

**222 - The Dairying Industry in South Africa.** — BAYNES, JOSEPH, in *The South African Journal of Industries*, Vol. I, No. 2, pp. 124-126. Pretoria, October, 1917.

Of recent years the dairying industry in South Africa has progressed considerably. Whereas, in 1906, the Union imported 11 273 748 lb. of butter, in 1909, 4 512 895 lb., in 1912, 4 925 188 lb., in 1915, 2 026 258 lb.; in 1916 the importation was reduced to 267 896 lb., and, up to the end of June, 1917, 2  $\frac{3}{4}$  million pounds had been exported to the London markets. The number of manufacturing dairies had risen to 53, that of the collecting centres to 10 in active operation. The cheese industry has made similar progress to a small extent; the importation of cheese fell from 5 586 244 lb. in 1913 to 2 028 508 lb. in 1916, and is continually decreasing. South Africa now produces over two million pounds of cheese equal in quality to the best imported cheese.

It seems that before long the condensed milk industry will make such progress as to render unnecessary all importation of this article, which before the war reached a value of £ 500 000.

Moreover, pig-breeding and the production of bacon and lard, the importation of which reached a value of £ 224 614 in 1916, may in future be quite independent of outside help, especially if the farmers perfect the breeds and produce a sufficient supply of suitable material for the bacon curing factories which are about to be established.

New Zealand is quoted as an example for South African farmers; this colony, with a smaller population than the Union, exported in 1914 42 000 000 lb. of butter, not to mention the other products for which it is famed. The price of good dairy land in New Zealand today is about £ 50 per acre, a price much above those realised in South Africa, where the land may well bear comparison with that of New Zealand in fertility and productivity.

The development of the dairy industry in South Africa still demands great attention with regard to the improvement of dairy stock, sweet cream and winter feeding. The movement for cow-testing associations should be encouraged in every way, so that farmers may be convinced that it is more advantageous to keep one good cow than three inferior ones.

The production of the best quality cream is of vital importance for the industry if South Africa is to compete satisfactorily with the other Dominions in superior quality products. The Dairy Bill, now under consideration, when passed, will control the improper grading of dairy products and protect alike the farmer, manufacturer and exporter against fraud.

223 - **Photographic Analysis of Dried or Fresh Eggs.** — LE ROY, GEORGES A., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No 25, pp. 1026-1028. Paris, Dec. 17, 1917.

In the trade, to differentiate eggs as regards freshness or more or less good state of preservation, the candling method is used *i. e.*, an optical examination by transparency, based chiefly on the size of their air space.

For legal purposes, the author devised a new method which is more exact, allowing the size of the air space to be gauged, and a graphic record to be taken, so as to form a convincing proof, which will be both lasting and suitable for purposes of comparison. The result is obtained by photography, together with special adjustment of the light and arrangement of the eggs, which are fully described, and extremely sensitive plates. By this method it is possible to obtain life-size photographs, by transparency, of groups of eggs and their air spaces, which may be measured by a graph placed over, or forming part, of the photograph.

The use of radiography for this purpose only gives deformed images very inferior to those obtained by the photographic method.

224 - **Dried Eggs (1).** — LINDET, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 40, pp. 1116-1119. Paris, December 19, 1917.

For some time past there have been on sale at Paris dried eggs from Hang-Tcheou (China), where an American factory, using a method already practised in Chicago, has been established.

The author does not know the method adopted, but does know that the water is evaporated at a temperature below 50-55° C. Egg albumen coagulates at 50-55°, and the author found in these eggs a quantity of uncoagulated soluble albumen, representing 30 % of the dry product, whereas eggs of normal composition have from 36 to 37 %; the albumen, therefore, is

(1) See also R. 1916, No. 1224. (Ed.).



not coagulated. To obtain a commercial evaporation at 50-55° C a mercury depression of 65-70 cc. is required; evaporation is, therefore, carried out in an almost complete vacuum. It is possible that a procedure is adopted similar to that proposed by MESSRS. BEVENOT and LENEVEU for the dessication of milk, which consisted in powdering the milk in a chamber the walls of which were heated.

The composition of these eggs is identical with that of normal eggs supposed to be dry. The author found 46.9 % of nitrogen, 42.4 % of fat; 3.5 % of salts; 7.2 % of moisture. The fact that the nitrogen and fat are present in almost equal proportions shows the eggs to be whole. The product contains no antiseptic.

One box contains the product of 12 eggs, weighing 150 gms., that is to say 139.2 gms. of chemically dry eggs, equal to 530 gms. of fresh eggs, or 12 eggs of 45 gms.

This egg powder will not keep an indefinite time; the fat easily becomes rancid. The product is shipped in refrigerators, and, while awaiting sale, is kept in cold storage at Clichy.

In the military hospitals of Paris, the chemists of which have all given a favourable report, these dried eggs are largely used and greatly appreciated.

225 - Production and Use of Pigskin: — See No. 191 of this Review.

226 - The Handling and Storage of Spring Wheat. — BAILEY, C. H., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 6, pp. 275-281, 5 diagrams. Washington, D. C., Sept., 1917.

Certain factors influencing the handling and storage of grain depend greatly on whether it is handled in bulk or in sacks. The storage of grain in bulk reduces the change in moisture content which is chiefly dependent on the climatic conditions prevailing between harvesting and threshing. If this period is warm and dry the grain will be well cured when it is sent to the consumer, but, if rain falls on the unthreshed bundles, especially on shocks, the wheat will be damp and tough, and, consequently, more difficult to handle and store.

Wheat assumes the temperature of the surrounding medium more rapidly when stored in sacks than in bulk, so that, in the first case, it is less subject to injury from fermentation.

Spring wheat is not biologically ripe at the time it is usually harvested. The process of ripening after the harvest is accompanied by certain peculiar phenomena. If the bundles are in a stack they absorb the moisture. This process, commonly called "sweating", is undoubtedly accompanied by biochemical changes resulting from enzymic activities within the kernel. If this sweating process occurs in normal wheat in the bin, a slight rise in temperature may result. The baking quality of the flour is improved by these changes in the grain.

Several factors determine the keeping quality after sweating; the most important of these is its moisture content at the time of storage. It is probable that, in dry grain, the amount of water absorbed is not sufficient

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to produce a gel, *i. e.* the colloidal material does not have a continuous structure, thus greatly reducing the possibilities of diffusion.

The exact percentage of moisture below which this discontinuous structure exists is not known; it probably varies with the percentage of gluten in the grain as gluten has a greater water-absorbing power than starch. Increasing the moisture content above the maximum at which discontinuity exists results in the formation of an elastic gel through which diffusion can take place. Further increases in moisture content up to saturation (maximum absorption) produce progressively less viscous gels with a corresponding increase in the rate of diffusion. Since the rate of respiration in grain doubtless depends in part on the rate of diffusion between the various kernel structures, it follows that the less viscous the gelatinous material of which the cell contents are composed, the more rapid is the production of heat through respiration. For these reasons the susceptibility to heating of grain stored in the bulk is largely determined by its moisture content.

To ascertain the percentage of moisture which spring wheat may contain without heating in store, the Minnesota Grain Inspection Department and the State Board of Grain Appeals, in cooperation with the Division of Agricultural Chemistry of the University of Minnesota, made observations on the wheat stored by one of the large elevator companies. About 20 lots of wheat, containing from 12.76 to 17.45 % of moisture, were examined. The observations lasted over a year, from one summer to the following summer. From the results it was concluded that hard spring wheat, of reasonable plumpness, containing less than 14.5 % of moisture is not likely to heat when stored under normal conditions in a temperate climate, whereas similar wheat, containing 15.5 %, or over, of moisture is practically certain to heat. Between these limits the possibilities of heating depend on the following conditions: — the percentage of moisture, temperature of the atmosphere, position of bin in the elevator (the grain keeps better in the outside bins than the inside ones), material of which the bin is constructed, initial temperature of the wheat (the curve illustrating the acceleration of respiration with a rise in temperature is logarithmic), size or dimension of the bulk, etc. In uniformly mixed wheat the highest temperatures are usually near the surface; when the surrounding air is cold, as in midwinter, the maximum temperature is usually from 15 to 20 feet below the surface; in mild or hot weather, it is found at a depth of from 5 to 8 feet.

227 - **Substitutes for Tin Cans.** — *The Tea and Coffee Trade Journal*, Vol. XXXII No. 6, pp. 536-540. New York, June, 1917.

Owing to the shortage of tin and the consequent inability of tin can manufacturers to meet fully the needs of their customers, attempts have been made to replace this metal by various paper, fibre and composite products. Manufacturers of such materials declare that their boxes preserve and carry dry products as well, and in some cases better, than all-tin boxes. The types of packing now in use may be divided into five: —

1) **Cardboard.** — This is now generally used for packing tea and coffee, especially for medium qualities, many firms reserving their tin boxes

for the best qualities only. It has been said that coffee packed in cardboard loses its aroma, but this may be prevented by the use of impermeable wrappers. The increasing popularity of cardboard is undoubtedly due to its low cost and adaptability to modern packing machinery.

2) *Paper*. — In spite of its increasing price paper is the cheapest wrapper now on the market. It may be made very attractive and is being used more and more extensively every day. It is regularly used for flour, cereals, spices, cocoa, chocolate, drugs and sugar.

3) *Fibre*. — This class includes the cylindrical box used by the QUAKER OATS COMPANY; it is made entirely of fibre board with a slip cover. As the fibre is not treated in any way, a liner is usually considered necessary. This packing may be made to look practically like a tin box, and is much in demand by manufacturers who wish to imitate as nearly as possible the old tin cases.

4) *Paraffined fibre*. — Paraffined packing is rapidly coming to the fore. All the models have an outer covering of paraffin, the manufacturers claiming to have special processes by which the paraffin is made to penetrate the pores of the paper. These cases are substantial in appearance and are made in a variety of shapes. It is claimed that the paraffin adds considerably to the flavour-retaining properties of the package, as well as making it moisture-proof.

5) *Composite*. — By this name are known boxes of fibre with tin tops and bottoms. This model is made in various shapes and combines the advantages of cardboard with those of tin. The metal parts increase the rigidity and durability of the packing, whereas the fibre sides eliminate the necessity of labelling by allowing designs and lettering to be stamped on the material.

The shortage of tin has also increased the demand for wood and fibre shipping cases. There are many models in sizes varying from 25 to 200 lbs. capacity. The prevention of loss through moisture or odour is specially aimed at.

A list of American manufacturers of boxes in cardboard, paper, fibre, etc. is given.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

228 - Fungi from Tropical Africa, California and New Zealand. — WAKEFIELD, F. M., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, Nos. 9 and 10, pp. 308-314, figs. London, 1917.

The paper under review includes eight species of fungi, known or suspected to be parasites. Three of them, *Polyporus coffeae*, *Helicobasidium longisporum* and *Cercospora cannabina*, occur on economic plants, and may prove to be of some importance. The parasitism of the two first has not been proved, but it is possible that *Helic. longisporum* at least may be capable of causing injury. The specimens examined by the author are the only ones reported so far.

The list includes the following species, the diagnosis of which is given in latin:—

1) *Polyporus Coffeae* Wakef., at the roots of a dead coffee tree at Kampala (Uganda); it is suspected of having caused the death of the tree; the fructifications were found surrounding the collar of the plant, the roots of which were encrusted with a layer of white mycelium mixed with sand; on this crust were conidial fructifications which may be connected with the *Polyporus*;

2) *Amauroderma infundibuliforme* Wakef., on the ground beneath a dead tree, Bumpenge Forest (Uganda);

3) *Hexagonia subvelutina* Wakef., on wood, in the East Africa Protectorate;

4) *Helicobasidium longisporum* Wakef., on roots of *Theobroma Cacao*, in Uganda, the affected roots show internal mycelium, especially along the medullary rays; MR. W. SMALL, who found the fungus, is inclined to consider it parasitic;

5) *Tilletia Wilcoxiana* Griffiths, on a specimen of *Stipa eminens* var. *Andersonii* Vasey, from Santa Catalina Island (California), and preserved in the Kew Herbarium;

6) *Uromyces Secamonae* Wakef., on leaves of *Secamone platystigma*, in Uganda ;

7) *Puccinia Hoheriae* Wakef., on leaves and stems of *Hoheria populnea* (Lacebark), New Zealand ;

8) *P. Berkheyae* Wakef., on leaves of *Berkheya Spekeana*, in Uganda ;

9) *Puccinosira Dissotidis* Wakef., on leaves of *Dissotis incana* and *Dissotis* sp., in Uganda ; this is the only species of *Puccinosira* for which an aecidium stage has been described (*Aecidium Dissotidis* Cooke) ;

10) *Cercospora cannabina* Wakef., on leaves of *Cannabis sativa*, in Uganda.

229 - Selected Danish Barleys Resistant to *Ustilago Hordei*, *U. nuda* and *Septoria graminum*, Introduced into the United States of America. — See No. 138 of this Review.

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230 - A Rust-resistant, Danish *Festuca elatior*, Introduced into the United States of America. — See No. 138 of this Review.

231 - "New Era", a New Zealand Potato Resistant to Mildew. — See No. 138 of this Review.

232 - On Forms of the Hop (*Humulus Lupulus* L.) Resistant to Mildew (*Sphaerotheca humuli* D. C. Burr.) (1). — SALMON, E. S., in *The Journal of Agricultural Science*, Vol. VIII, Pt. 4, pp. 455-460. Cambridge, December, 1917.

In certain seasons, such as 1916, very severe losses are caused to the hop-crop by attacks of the mildew *Sphaerotheca Humuli* (DC) Burr. Within recent years the hop-mildew has also appeared in epidemic form in the United States. The fact that certain forms of the hop-plant are very resistant to *Sph. Humuli* is, therefore, of great scientific and economic interest.

While the morphological species of *Sph. Humuli* attacks a very large number of host-species belonging to many different genera, experiments have proved that a specialisation of parasitism has taken place, and that the form on *Humulus* constitutes a "biologic form" with the power, so far as is known, of infecting only species of this genus.

Resistance to hop-mildew was first observed during the summer of 1914 at the South-Eastern Agricultural College, Wye, Kent. Several hundred one and two year old seedling hops were grown in pots in a greenhouse under conditions which ensured their being attacked by mildew. Of these plants, two proved immune throughout the growing season in spite of repeated attempts to infect them directly and indirectly. These plants were grown from seed of a hop found wild in hedges at Vittorio (Treviso, Italy) collected in October 1913 by Prof. P. A. SACCARDO. About 70 other seedlings of the same origin, the same age and grown under conditions identical with those of the first two, proved very susceptible to mildew.

During 1916 the same resistance to mildew was noticed in 7 others of the same Italian origin and of the same age as the immune plants observed in 1914. Whereas these seven plants remained immune throughout the

(1) See also R. Dec., 1917, No. 1142. (Ed.)

growing period, 150 seedlings of the same age and origin, grown in the same greenhouse, proved very susceptible to mildew.

The same complete immunity was shown in 1916, under the same conditions, by three plants of a form of *Humulus Lupulus* with yellow leaves, received, under the name of "golden hop", from Messrs. Bide and Sons of Farnham, who had bought it from Mr. G. Benard of Orleans.

The two seedlings found to be immune in 1914 were planted out during the winter 1914-15. They developed normally and, in 1916, flowered; it was then seen that one plant was male, the other female. Throughout the summer and early autumn these seedlings showed no trace of mildew although all the surrounding hops were attacked. Nevertheless, by October 3, a few leaves and flowers of a late shoot of the female plant, and two leaves, each on one of two late lateral shoots of the male plant, showed small patches of mildew.

In 1902, NEGER pointed out the possibility of the existence of "immune races" among host-species susceptible to mildew, and described instances where individual plants of *Spiraea Ulmaria* and *Epilobium montanum* resisted all infection from the conidia of *Sph. Humuli* which had developed on the same host-species.

According to Prof. KINGO MIYABE, the "biologic form" of *Sph. Humuli* which attacks *Humulus* does not exist in Japan, although the species *Sph. Humuli* is very common there on a certain number of host-species belonging to different genera. In 1916, the author received from Prof. MIYABE specimens of the male plant of the wild hop of Japan (*H. Lupulus* var. *cordifolius* Maxim). When grown in the greenhouse where, as already stated, the conditions were favourable to inoculation by conidia of the form of *Sph. Humuli* which lives on hops, the plants were infected.

A similar case is undoubtedly that of the "immunity" of Virginia creeper (*Vitis hederacea*) in Europe. In the United States this plant is attacked by vine mildew (*Uncinula necator* [Schwein.] Burr.). This mildew is very common in Europe on cultivated vines, but, within the author's knowledge, has never been found attacking Virginia creeper, doubtless because specialisation of parasitism has occurred in the species *U. necator* and the "biologic form" attacking *Vitis hederacea* has not yet reached Europe.

At the present time there are no restrictions in England on the importation of *Vitis hederacea* from America. To protect this plant from the danger of being attacked by mildew, the English authorities should prohibit this importation or inspect the imported plants closely.

233 — "K'nei li tzu", a Chinese Chestnut Resistant to the "Ink Disease", introduced into the United States of America. — See No. 138 of this Review.

234 — Patents for the Control of Diseases and Pests of Plants. — See No. 210 of this Review.

235 — Disease and Pests of Lucerne in the Oasis of Tripoli. — See No. 163 of this Review.

MEANS  
OF PREVENTION  
AND CONTROL

DISEASES  
OF VARIOUS  
CROPS

[232-235]

236 - **The South American Hevea Leaf Disease in Trinidad.** — RORER, J. B., in *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Pt. 3, pp. 128-129, Port of Spain, 1917.

In July, 1916, the author's attention was called to a disease of the leaves of hevea trees (*Hevea brasiliensis*) which was causing considerable defoliation on many different estates in widely separated parts of Trinidad. Microscopic examination showed the disease to be the South American Hevea Leaf Disease, which, judging by its general distribution, must have existed in the island for several years, but only became epidemic in July, August and September, 1916, when the climatic conditions were exceptionally favourable to fungous growth.

The disease was first reported in Surinam (Dutch Guiana) in 1910, and was carefully studied by Dr. KUIJPER, who published a report on it in 1912. At that time the disease was confined to nursery stock and young trees, while the older plantations seemed quite free from infection. During the past four years, however, both in Surinam and Demerara (British Guiana), the disease has spread rapidly to the older Hevea trees, and must now be considered as the most serious disease of this plant in that part of the world.

Dr. GEROLD STAHEL, Mycologist to the Department of Agriculture of Surinam, has made a long and careful study of the disease. He has determined that it is caused by a fungus with three different fruiting stages, only one of which spreads the fungus. This form belongs to the genus *Scolecotrichum*, and its spores are produced in abundance chiefly on the under side of the very young, diseased leaves. These spores, carried by the wind, rain or insects, germinate and penetrate the young tissues of the leaves very rapidly (10 hours), and thus cause widespread epidemics under suitable weather conditions. After 15 hours' drying they lose their germinating capacity.

- The other two forms of the fungus occur on or around the edge of the spots on the older leaves. They appear as small, black pustules, similar in external appearance, but some contain spores of one kind, some spores of another kind. Dr. STAHEL's work shows that these two types of spores are only very slightly capable of infecting the leaves, and may be entirely disregarded as a cause of the spread of the fungus.

Dr. STAHEL states that very many rubber trees in Surinam are attacked by this disease, and that, on parts of some estates, as many as 20 % of the trees have been killed by it. According to BANCROFT the disease is also widespread, virulent and epidemic in Demerara.

No successful means of fighting the disease on large trees has yet been found. When it attacks nursery stock or young trees in the field it may easily be controlled by spraying with Bordeaux mixture.

The disease occurs in several districts in Trinidad, and was more widespread in 1917 than in the preceding year. In June 1917, the author visited a number of plantations and found the trees in normal condition. Nevertheless, in one or two places where the disease was not prevalent in 1916, the trees were badly attacked; one or two old trees were killed by the re-

peated attacks, and a number of two and three year old trees died on account of the repeated defoliation.

The disease does not appear to be so virulent in Trinidad as in Surinam and Demerara, probably on account of the less favourable climatic conditions for fungous growth; nevertheless it must be considered as a latent menace to the rubber industry in the island.

Spraying large rubber trees is practically out of the question on account of the expense; for this reason it is important to find and grow resistant individuals or varieties. As is now being done elsewhere, seeds should be selected in Trinidad from the trees giving the highest yields of latex, so as to use them for future plantations.

237 - **Endrot of Cranberries** (1). — SHEAR, C. L., in the *Journal of Agricultural Research* Vol. XI, No. 2, pp. 35-42, figs. 1-3, plate A. Washington, D. C., October, 1917.

i A disease of cranberries (*Oxycoccus macrocarpus*), called "endrot" is reported. It is caused by a sphaeropsidaceous fungus which does not appear to have been described previously and which is provisionally placed in the genus *Fusicoccum* under the name of *F. putrefaciens*.

The disease has been observed in all the cranberry-growing districts of the United States (Massachusetts, Maine, New Jersey, Michigan, Wisconsin, Washington, Oregon), and of recent years has caused considerable loss of the Late Howe variety, as well as attacking other varieties (Bennet Jumbo, Cape Cod Beauty, Early Black, Early Ohio, Mathews, Mc Farlin, Perry Pride, Prolific, Searles Jumbo, Selected Howe, Vose Pride, etc.).

The rot caused by the parasite usually starts as the blossom or stem end of the berry, hence the common names "blossom end rot" and "stem end rot", now replaced by the simple term "endrot". The fruit attacked eventually softens all over.

Only the pycnidial form of *F. putrefaciens* has been produced in culture. Dried, rotten, mummified berries, apparently destroyed by *F. putrefaciens*, left exposed in the field and examined after about a year and a half, showed a discomycetous fungus which is believed to be the perfect form of the parasite and which agrees very closely with *Cenangium urceolatum* Ellis.

Cultures of the mycelium show a characteristic series of colours and produce fertile pycnidia, more frequently on *Melilotus alba* than on other media.

Spraying experiments in Massachusetts show that this rot can be largely controlled by the use of Bordeaux mixture.

Some injury to the cranberry vines was noticed at the Massachusetts Cranberry Experiment Station at East Wareham which it was thought might be due to the use of Bordeaux mixture. The real cause of this injury, which was not found in other districts, is being investigated.

238 - **Watermelon Diseases in U. S. A.** — ORTON, W. A., in U. S. Department of Agriculture, *Farmers' Bulletin* 821, pp. 18, figs. 12. Washington, D. C., May, 1917.

A brief description of the diseases of watermelons (*Citrullus vulgaris*), particularly those found in the south-east of the United States, together with the methods of control, is given.

(1) See also R. April, 1916, No. 470. (Ed.)



The most common and most serious diseases are : —

- 1) wilt (*Fusarium nivium* Erw. Sm.) ;
- 2) root-knot (*Heterodera radicleola* [Greef] Muller) ;
- 3) anthracnose (*Colletotrichum lagenarium* [Pass.] Ell. and Halst.) ;
- 4) stem-end rot (*Diplodia* sp.).

The watermelon is also occasionally attacked by the following minor diseases : —

- 1) stem blight (*Mycosphaerella citrullina* [Sm.] Gr. ;
- 2) bacterial wilt (*Bacillus tracheiphilus* Erw. Sm.) ;
- 3) downy mildew (*Peronosplasmopara cubensis* [B. and C.] Clint) ;
- 4) malnutrition, attributed to lack of potash ;
- 5) blossom-end rot, probably due to defective pollination ;
- 6) ground rot (*Sclerotium Rolfsii* Sacc.).

## WEEDS AND PARASITIC FLOWERING PLANTS

239 - ***Kennedya rubicunda*, a Leguminous Plant Injurious to Forest Trees in New South Wales.** — MAIDEN, J. H., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 10, p. 714. Sydney, October, 1917.

*Kennedya rubicunda* Vent., a native plant of Australia, very common in the coastal district of New South Wales, has recently been reported by MR. G. F. MCPHERSON, District Forester at Wyong, as being very abundant in the forests of that neighbourhood. It is found especially on improved, areas, where it attacks and covers the young hardwood trees in a very short space of time. It is feared that the plant will become a danger to the forests by retarding the growth of the young trees.

240 - **Methods for the Control of "Wild Rice" in Italian Ricefields.** — See No. 161 of this Review.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

241 - **Observations on Animal Pests of Cultivated Plants, Made in Sweden from 1912 to 1916.** — TULLGREN, ALBERT, in *Meddelande No. 152 från Centralanstalten för försöksväsendet i Jordbruksområdet, Entomologisk Avdelningen* Nr. 27, pp. 1-104. Stockholm, 1917.

GENERAL

Thanks to the collaboration of many correspondents the Entomological Department ("Entomologisk Avdelningen") of the Central Experiment Station at Stockholm is able to collect and study material from all parts of Sweden, report the presence of destructive species, and study and make known the best means of control. The correspondents, 567 in number, are distributed as follows : — Malmöhus, 31 ; Kristianstads, 22 ; Blekinge, 10 ; Halland, 19 ; Kronoberg, 19 ; Jörrköping, 26 ; Kalmar, 27 ; Gotthland, 12 ; Östergötthland, 41 ; Skaraborg, 28 ; Alvsborg, 36 ; Göteborg and Bohus, 28 ; Örebro 22 ; Södermanland, 48 ; Västmanland, 14 ; Upsal, 28 ; Stockholm, 28 ; Värmland, 18 ; Kopparberg, 22 ; Gävleborg, 19 ; Jämtland, 24 ; Västernorrland, 16 ; Västerbotten, 19 ; Norrbotten, 10.

The publication under review gives data bearing on the period 1912-1916, during which not less than 345 animal species have been reported, distributed as follows : — orthoptera, 4 ; thysanoptera, 3 ; hemiptera, 41 ;

coleoptera, 85; lepidoptera, 106; diptera, 28; hymenoptera, 30; total number of insects, 297; myriapoda, 2; acarina, 19; snails, 1; nematodes, 2; birds, 14; mammals, 10.

Below are mentioned the species reported as new, or, on account of the damage they cause, deserving of special mention:—

*Gryllotalpa gryllotalpa* L. ("mullvadssyrsan") although relatively common in southern Sweden had not, for 25 years at least, caused such serious damage to crops as that reported from Skottorp (Halland) in the summer of 1916.

*Siphocoryne ligustri* Kalt. ("ligusterbladlusen,") reported for the first time in Sweden towards the end of June, 1915, on privet at Svalöv (Malmöhus district).

*Rhopalosiphum lactucae* Kalt. ("nyolktistelbladlusen"), judging by the distribution of the 55 reports received at the central office, causes serious damage in the frontier provinces between Svealand and Götaland, and in Lödermanland, Nerike and Västergötland. The southern districts, on the contrary, were almost completely immune as compared with those north of the Dal river. It is interesting that the white and red currant bushes were attacked by preference, the black varieties being hardly touched.

*Agriotes lineatus* L. ("randigasädes knäpparen") has caused considerable damage to agriculture in all districts of Sweden. In Svartingstorp (Kalm.) in 1912, some acres of sugar beets were entirely destroyed; the larvae were so abundant that 34 were collected from one root alone. In Häverö sund whole fields of oats were so severely attacked that, in many districts, they had to be re-sown. Similar occurrences were reported in Ämot and Värmland. The table given below is interesting from the point of view of the different plants' attacked.

Plants attacked	Number of attacks reported in:					Total number of attacks
	1912	1913	1914	1915	1916	
Oats . . . . .	64	38	44	53	30	229
Barley . . . . .	25	18	20	27	17	107
Wheat . . . . .	4	2	1	0	3	10
Rye . . . . .	3	1	2	8	3	17
Beet . . . . .	9	7	5	2	4	27
Potato . . . . .	6	8	7	3	5	29
Cabbage . . . . .	4	1	2	3	5	15
Turnip . . . . .	5	4	—	2	3	14
Carrot . . . . .	—	1	—	2	2	5
Onion . . . . .	1	—	—	—	2	3
Viper's grass . . . . .	—	—	—	—	1	1
Cucumber . . . . .	3	—	—	1	—	4
Salad . . . . .	2	2	—	1	—	5
Garden Strawberry . . . . .	—	—	1	—	—	1
Parsnip . . . . .	—	2	—	—	—	2
Asparagus . . . . .	1	—	—	—	—	1

Oats and barley were, therefore, most frequently attacked; cabbage, turnip, potato, beet, wheat and rye are also subject to attacks from *Agriotes*, but less frequently; the other plants may be considered as rare hosts.

*Apamea tostacea* Kb. ("gässrotflyet"), reported for the first time in Sweden at Svalöf on Gramineae in 1915.

*Dasyfolia templi* Thubg. ("fjäderborst flyet"), very rare in Sweden; in July, 1916, the larvae of this lepidopteron caused great damage to *Archangelica officinalis*, cultivated as a medicinal plant at Dals-Rostock.

*Callimorpha dominula* L. ("glansspinnaren"): the larvae of this lepidopteron, very rare in Scandinavia, caused great injury in the spring of 1914 to young elm and ash trees near Ovesholm (Kristianstadt).

*Enarmonia prunivora* Wlsh. (?) ("mindre äpplevecklaren") was noticed for the first time near Repelycke, Rännun, in November, 1915, on apples, and, on frequent occasions, in other localities. The Station has not yet been able to identify with certainty this insect, which, instead of being identical with the American *E. prunivora*, might form a native variety.

The birds reported as harmful during the period 1912-1916 were:

*Corvus cornix* L. ("kiäkan"); *C. frugilegus* L. (räkan); *C. monedula* L. ("kajan"); *Pica pica* L. ("skatan"); *Sturnus vulgaris* L. ("staren"); *Passer domesticus* L. ("gråsparven"); *Fringilla montifringilla* L. ("bergfinken"); *F. coelebs* L. ("bofinken"); *Loxia curvirostra* L. ("mindre korsnäbben"); *Pyrrhula pyrrhula* L. ("domherren"); *Turdus pilaris* L. ("snöskatan"); *T. merula* L. ("koltrosten"); *Larus canus* L. ("fiskmåsen"); *Tetrao migallus* L. ("tjädern").

Among the mammals reported as causing damage were:—

*Erinaceus europeus* L. ("sgelkotten"); *Talpa europaea* L. ("mullvaden"); *Sciurus vulgaris* L. ("äkorren") which destroys pears, apples and hazel nuts; *Microtus agrestis* L. ("akersorken"); *Arvicola terrestris* L. ("vättensorken"); *Lemmus lemmus* L. ("fjällemmel"); *Lepus timidus* L. and *L. europaeus* which gnaws the bark of fruit trees; *Alces alces* L. and *Capreolus capreolus* L., injurious to forest trees.

The attacks were frequent and serious, particularly in 1912-14, when the summers were very hot and dry; slight and less frequent in 1915 and 1916, rather wet and cold years.

The following particulars are worthy of note:—

CEREALS. — These suffered particularly from larvae of *Melolontha* sp. ("allonborren") and *Agriotes lineatus* L. throughout Sweden, but particularly in the southern districts, where, in 1912 and 1913, *Contarinia tritici* Kirby ("vetemygga") was also found in abundance in the barley and wheat fields. More or less serious damage was done by *Siphonella* (*Chlorops*) *pumilionis* Bjerk. ("kornflugan"); *Oscinella* (*Oscinis*) *frit* L. ("fritflugan"); *Hylemyia coarctata* Fall. ("rågbröddflugan"); and larvae of *Agrostis segetum* Schiff. ("sädesbröddflyet").

FODDER GRAMINEAE — *Amaurosoma* (*Cleigastrea*) *armillatum* Zett. and *A. flavipes* Fall., which lower the yield in seed of *Phleum* by 25 %.

CLOVER. — *Apion apricans* Herbst. ("Kloverspetviveln") for the seed, and a nematode, *Tylenchus devastatrix* Kuhn., for the hay.

CABBAGE and TURNIP. — *Phyllotreta* sp. ("jordlopporna"); *Plutella maculipennis* Curt. ("kålmalen"); *Eurydema oleracea* L. ("rapssugaren"); *Lygus pratensis* L. ("angstinkfiyet") in Norrland; and *Chortophila* (*Phorbia*) *brassicae* Bouché ("kålfugan").

CARROT. — *Trioza viridula* Zett. ("morotbladloppan") and *Psila rosae* L. ("morotflugan").

BEE. — *Blithophaga* (*Oiceoptoma*) *opaca* L. ("gulhåriga skinnarbaggen")

LEGUMINOSAE. — *Physopus robusta* Uzel ("vanliga arttripsen"); *Sitona lineata* L. ("årtviveln") and *Grapholihia nigricana* Stph. ("årtvecklaren").

FRUIT TREES — *Psylla mali* Schmbg ("applebladloppan"); *Psylla* sp. ("påronbladloppor"); *Aphis pomi* D. G. ("applebladlusen"), especially in the very hot summer of 1914; *Anisandrus* (*Xyleborus*, *Scolytus*, *Tomicus*) *dispar* F. ("lövvedborren"); *Phyllobius* sp. ("lövvivlar") in 1912; *Anthonomus pomorum* L. ("äppleblomviveln") in 1913-1914; *Cheimatobia brumata* L. ("frostfjäriln"); *Argyresthia conjugella* Zell. ("rönnbärsmalen") in 1916; *Malacosoma neustria* L. ("ringspinnaren").

Besides the lepidoptera already mentioned there were: *Argyroplote* (*Olethreutes*) *variagana* Hb. ("vanliga knoppvecklaren"); *Tmetocera ocellana* F. ("mindre k"); *Carpocapsa pomonella* L. ("applevecklaren"), very common; *Hyponomeuta malinellus* Zell. ("äpplespinmalen"), and *Lyonetia clerkella* L. ("clerksminerarmal").

The pear trees suffered very severely from *Contarinia pyrivora* Ril. ("pårongallmyggan"); plum trees from *Hoplocampa minuta* Christ. ("plommonstekeln"), which reduced the crop by 20 to 80 % (as at Kivik, Fjälkestad); both species were very abundant in 1912 and 1913 throughout southern Sweden.

\* BERRIES — *Pterodinea* (*Pteronius*) *ribesii* Scop ("stora krusbärsstekeln") and *Pristiphora appendiculata* Lep. ("lilla K."), on gooseberry; *Rhopalosiphum lactucae* Kalt. ("mjölkstistelbladlusen") on red currant (1915); *Anthonomus rubi* Hbst. ("hallonviveln") on strawberries and raspberries.

FOREST TREES. — *Cheimatobia boreata* Ln. ("bjork frostmätaren") and *Coleophora fuscadinella* Zell. ("bjork sackdrogarmalen"), very plentiful, especially in 1912; *Myelophilus piniperda* L. ("svarta margboren") and *M. minor* ("mindre m."); *Dendroctonus micans* Kug. ("fättekarkborren") and numerous species of the genera *Ips* and *Pityogenes*.

242 - Scale Insects (*Coccidae*) from Asia, Africa, America and Oceania. (1). — NEWSTEAD, ROBERT, in the *Bulletin of Entomological Research*, Vol. VIII, Pt. 2, pp. 125-134. London, December, 1917.

The following species are enumerated:

1) *Aspidoproctus armatus* Newst., on a tree of unknown species, San Salvador (Portuguese Congo);

2) *A. P. glaber* Lind., on the tree locally known as "mwanga", Mlanje (Nyasaland);

(1) See R. Oct., 1917, No. 977 and No. 244-244 of this Review. (Ed.)

3) *A. pertinax* Newst., on a tree known as "kalati" in the preceding locality; the same scale seems to have been observed on a wild plant at Bangalore, Lal Bagh (South India);

4) *A. tricornis* Newst., on the "mwanga" tree, Mlanje;

5) *Icerya aegyptiacum* Dougl., on young date palm, Zanzibar; this is the first record of this scale at Zanzibar;

6) *I. maxima* Newst., on tree trunk Ngamba Is., Lake Victoria (Uganda);

7) *I. seychellarum* Westw., on mango, Entebbe (Uganda);

8) *I. sulfurea* Lind., on *Eranthemum* in the preceding locality, and doubtfully on *Castilloa* at Kampala (Uganda);

9) *Stictococcus formicarius* Newst., on *Ficus* sp., Entebbe;

10) *St. multispinosus* Newst., on *Cola acuminata*, Aburi (Gold Coast); a small percentage of the females were attacked by chalcidid parasites; on *Markhamia platycalyx*, Kampala (Uganda);

11) *Sy. sjöstedti* Ckll., on cacao, Aburi;

12) *Pseudococcus citri* Risso, at Nairobi, Old Government Farm (British East Africa); on coffee, at Entebbe; on an unknown shrub, Tero Forest (Uganda);

13) *Ps. sacchari* Ckll., on rice, at Megapatan (Madras Pres.); on sugar cane at Georgetown (British Guiana);

14) *Ps. hymenocleae* Ckll., host plant not stated, at Onderstepoort, Transvaal (South Africa);

15) *Ps. virgatus* Ckll., on coffee, Nama Konkoni, Chagwe (Uganda); on cassava and sugar cane, Zanzibar; on French beans, *Jatropha Curcas* and *Colocasia*, Aburi (Gold Coast); on oleander and a creeper called "Salonica", Accra (Gold Coast); on cacao seedlings, Ibadan (Southern Nigeria);

16) *Phenacoccus insolitus* Green, on egg-plant, Saidapet (Madras);

17) *Tacchardia decorella* Mask., on *Anona muricata*, badly infested, Entebbe; Pretoria (South Africa);

18) *Asterolcanium coffeae* Newst., on coffee plants in British East Africa and in Uganda (Nakasanje, Chagwe; Banda); heavy infection; a small percentage of the specimens were infected by chalcidid parasites;

19) *A. bambusae* Bdv., on bamboo, at Aburi (Gold Coast) and at Entebbe (Uganda); also found in South Africa;

20) *Cerococcus hibisci* Green, on egg-plant, Guntur (S. India);

21) *Ceroplastodes cajani* Mask., on red gram, *Zizyphus*, *Ocimum sanctum*, Coimbatore; on wild indigo, Anantapur Dist. (S. India);

22) *Inglisia chelonioides* Green, on *Parkinsonia aculeata*, Coimbatore;

23) *I. conchiformis* Newst., on *Gliricidia maculata*, Aburi;

24) *Ceroplastes actiniformis* Green, on coconut, Coimbatore;

25) *C. africanus* Green, in South Africa; on acacia, N. E. of Lake George (Uganda);

26) *C. ceriferus* Anderson, on wild elm, Coimbatore;

27) *C. cirripediformis* Comst., on *Hura crepitans* in association

with *Lecanium* (*Akermes*) sp., Berbice (British Guiana); on *Ipomoea* sp., Georgetown;

28) *C. denudatus* Ckll., on a wild Solanaceae, Demerara (British Guiana);

29) *C. ficus* Newst., on *Ochra pulchella*, Wonderboom (South Africa); on *Anona*, Aburi;

30) *C. personatus* Newst., on *Coffea liberica*, Aburi;

31) *C. quadrilineatus* Newst., Kimi Is., Lake Victoria (Uganda);

32) *C. rubeus* Mask., on mango, Ganyon District, Chicacola (S. India); on young orange trees, Maruhubi, Zanzibar;

33) *C. ugandae* Newst., on an unknown tree, Mount Mubendi (Uganda);

34) *C. vinsonioides* Newst., on coffee, Mabira Forest (Uganda);

35) *Pulvinaria burkilli* Green, on *Zizyphus* sp., Coimbatore;

36) *P. cupaniae* Ckll., on *Ficus* sp., badly infested; on mulberry imported from U. S. A., Jamaica;

37) *P. jacksoni* Newst., on *Eranthemum bicolor*, Kampala (Uganda); on granadilla, Nairobi (British East Africa);

38) *P. psidii* Mask., on coffee badly infested, Mabira (Uganda); on the same plant at Mpumu, Chagwe (Uganda); on coffee at Kikuya (British East Africa) and on "usambyia" at Bukoba (British East Africa); on mango, Coimbatore; on guava, Koilpata (S. India);

39) *Lecanium* (*Saissetia*) *cuneiformis* Green, on *Acokanthera* sp., Mua Hills (Brit. E. Africa);

40) *L. (S.) hemisphaericum* Targ., at Limosa (Brit. E. Africa); on *Aristolochia*, Nagunga; on *Adiantum*, Entebbe; on coffee, Mabira (Uganda);

41) *L. (Coccus) hesperidum* L., on banana, near Mombasa; on lemon, Mua Hills (Brit. E. Africa);

42) *L. (S.) nigrum* Nietn., on *Lawsonia alba* and on cotton, heavily infested, Coimbatore; on coffee, Mwera (Uganda); on ornamental shrub, Government Farm, Kabete (Brit. E. Africa);

43) *L. (Eulecanium) somereni* Newst., on *Erythrina excelsa*, Nagunga (Uganda); specimen heavily parasitised;

44) *L. (Eucalymnatus) tessellatus* Sign., on Malacca apple associated with *L. wardi*, Botanic Gardens, Georgetown (British Guiana);

45) *L. (Coccus) viride* Green, on Liberian coffee, Onderneeming, Essequibo (Brit. Guiana); also observed in S. Africa;

46) *Hemilecanium imbricans* Green, on *Cedrela Toona*, heavily infested, Southern Mysore (S. India);

47) *Aspidiotus* (*Chrysomphalus*) *aurantii* Mask., on orange tree, Kabete (British E. Africa); on Mount Chirinda, Masetter (Southern Rhodesia); the insect was heavily infested by *Nectria* (?) sp.; chalcidid parasites were also present; a few specimens on *Acacia* in association with *Chionaspis capensis* Newst., at Pretoria (S. Africa); on citrus imported from India in 1913, in Jamaica; on bananas, Taveuria (Fiji);

48) *A. camelliae* Sign., on apple and rose tree, Nairobi; on trunks of black wattle, on apple and fig, Kabete (Brit. E. Africa);

- 49) *A. cyanophylli* Sign., on peach, Entebbe (Uganda) ; on banana, Taveuria (Fiji) ;
- 50) *A. cydoniae* Comst., on mango, Kabete, on Bauhinia, guava, rose shrubs, Entebbe ; on Cape lilac, Kampala (Uganda) ; on oleander, Accra (Gold Coast) ; on *Nectandra coriacea*, Jamaica ; on fig fruit and on vine, Coimbatore ; on pear, Bangalore (S. India) ; .
- 51) *A. destructor* Mask., on coconut leaves, heavily infested, but about 70 % destroyed by a small coleopterous larva, Cochin State, Kimbalengua (S. India) ; on mango in association with *Lecanium adersi* Newst., and on stems of castor oil plant, Marahubi (Zanzibar) ; on an unnamed plant, S. Africa ; on coconut palm, Mombasa (Brit. E. Africa) ; on banana, Kisubi ; on mango, guava, screw-pine and Ceara rubber, Entebbe ; on banana and *Hevea brasiliensis*, Kampala (Uganda) ; on mango, Accra and on *Pandanus*, Aburi (Gold Coast) ;
- 52) *A. (Chrysomphalus) dictyospermi* Morgan, at Fort Beaufort (S. Africa) ;
- 53) *A. (Chrys.) ficus* (Riley) Comst., on mango, Coimbatore ; on *Ficus* sp., Pemkonda (S. India) ;
- 54) *A. (Pseudaonidia) fossor* Newst., on grape vine, Georgetown (Brit. Guiana) ;
- 55) *A. orientalis* Newst., in Brit. E. Africa, on tamarind fruit, very heavily infested, at Coimbatore ; on egg-fruit, heavily infested, Guntur (S. India) ;
- 56) *A. (Chrys.) rossi* Mask., on *Eucalyptus* sp., Modderfontein (S. Africa) ;
- 57) *A. (Pseudaonidia) tesseratus* d'Emm., on *Matayba apetala*, *Nectandra coriacea*, *Trophis racemosa*, all heavily infested, Jamaica ;
- 58) *A. (Ps.) trilobitiformis* Green, in Coimbatore (S. India) ; on oleander and mango, Kampala (Uganda) ;
- 59) *A. (Chrys.) triglandulosus* Green, attached to scabs on Jack leaf, Bangalore (S. India) ;
- 60) *A. (Selenaspidus) silvaticus* Lind., on orange tree, Entebbe (Uganda) ; 50 % of the females were attacked by a parasitic fungus ;
- 61) *A. (S.) articulatus* Morgan, on citrus imported from India, Kingston, Jamaica ;
- 62) *Chionaspis (Hemichionaspis) minor* Mask., host plant not stated (cotton ?), Ibadan (S. Nigeria), on *Jatropha Curcas*, Aburi (Gold Coast) ; on willow trees, Drakensburg, Cape Province (S. Africa) ;
- 63) *Ch. dentilobis* Newst., on unnamed plant, Entebbe ; a large percentage of the females were parasitised by chalcid hymenoptera ;
- 64) *Ch. (Phenacaspis) lutea* Newst., on *Funtumia*, Aburi (Gold Coast) ;
- 65) *Fiorinia proboscidiaria* Green, on citrus imported from India, Kingston, Jamaica ;
- 66) *Parlatoria pergandei* Comst., on the same plant in the same locality ;
- 67) *P. zizyphus* Lucas, as the two preceding cases ;

68) *Ischnaspis filiformis* Doug. on *Ficus* sp. in Jamaica, on coffee, Mabira Forest, Chagwe (Uganda) ;

69) *Mytilaspis* (*Lepidosaphes*) *citricola* Pack., on sickly lime-tree, Accra (Gold Coast) ;

70) *Lepidosaphes glöverii* Pack., on croton, Entebbe (Uganda).

243 - A List of Uganda Coccidae, their Food-Plants and Natural Enemies (1). — GOWDEY, C. C., in *Bulletin of Entomological Research*, Vol. VIII. Pt. 2, pp. 187-189. London, December, 1917.

The list includes :

- 1) *Monophlebus raddoni* Westw., food plant unknown ;
- 2) *Icerya caudata* Newst., on crotons (*Codiaeum*) ;
- 3) *I. nigroareolata* Newst., on coffee and crotons ;
- 4) *I. seychellarum* Westw., on *Monodora Myristica*, *Eranthemum bicolor* and mango ;
- 5) *I. sulphurea* Lind., on *Castilloa* rubber (*Castilloa*) and guava (*Psidium Guajava*) ;
- 6) *Asterolecanium bambusae* Bdv., on bamboo ;
- 7) *A. coffeae*, Newst. on coffee ;
- 8) *Pseudococcus bromeliae* Bouché, on pine apple ;
- 9) *Ps. citri* Risso, on coffee (leaves, stems and roots), orange, lemon and cacao ; the root form is accompanied by an ant *Acropyga gowdeyi* Wheeler ;
- 10) *Ps. virgatus* Skll., on coffee ;
- 11) *Tachardia decorella* Mask., on *Anona muricata* and guava ; parasitised by *Aenasiella africa* Gir. and *Coccophagus nigropleurum* Gir., and preyed on by caterpillars of *Stathmopoda oestëdis* Meyr. ;
- 12) *T. longisetosa* Newst., on guava, *Ficus Thonningii*, and *Anona muricata* ;
- 13) *Pulvinaria jacksoni* Newst., on cotton ; parasitised by *Tetrastichus gowdeyi* Crawford ;
- 14) *Pulv. psidii* Mask., on coffee, *Funtumia elastica*, guava, tea, *Alternanthera versicolor* and *Dolichandrone platycalyx* ;
- 15) *Pulv. subterranea* Newst., on roots of *Chrysanthemum* ;
- 16) *Ceroplastes africanus* Green, on *Cajanus indicus* and *Acacia* sp. ;
- 17) *C. ceriferus* And., on coffee, *Antigonon leptopus*, orange, *Funtumia latifolia*, *Canna*, *Hibiscus*, *Agave*, croton, *Anona muricata*, tea and *Ficus Thonningii* ;
- 18) *C. conformis* Newst., on *Ficus* sp. and *Hura crepitans* ;
- 19) *C. destructor* Newst., on guava ;
- 20) *C. ficus* Newst., on *F. Thonningii* ;
- 21) *C. galeatus* Newst., on coffee and *F. Thonningii* ; parasitised by *Neomphaloidella ceroplastae* Gir., *Eurytoma galeati* Gir. and *Scutellista cyanea* Motsch. ;
- 22) *C. quadrilineatus* Newst., on *Anona muricata* and *Dolichandrone platycalyx* ;
- 23) *C. singularis* Newst., on guava ;
- 24) *C. subdenudatus* Newst., on an undetermined plant ;
- 25) *C. ugandae* Newst., on *Anona muricata* and *Acacia* sp. ;
- 26) *C. vinsonioides* Newst., on *Baikiaea Emirii*, coffee, guava and *Cajanus indicus* ;
- 27) *Inglisia castilloae* var. *theobromae* Newst., on cacao ;
- 28) *I. conchiformis* Newst., on *Hibiscus*, *A. muricata*, *Acalypha*, *Haronga madagascariensis* and guava ; preyed on by *Eublemma scitula* Ramb. ;
- 29) *Ceroplastodes gowdeyi* Newst., on *F. Thonningii* ;
- 30) *Coccus africanus* Newst., on coffee ;

(1) See also *B. Nov.-Dec.*, 1911, No. 3257 ; *B. Aug.*, 1913, No. 1010 ; *B. March*, 1914, No. 293 ; *R. Oct.*, 1917, No. 977. (*Ed.*)



- 31) *C. discrepans* Green, on tea roots ;
- 32) *C. elongatus* Sign. on *Albizzia* sp. and *Cajanus indicus* ;
- 33) *C. hesperidum* L., on orange ;
- 34) *C. setiger* Newst., on guava ;
- 35) *C. longulus* Dougl., on *Gliricidia maculata* ;
- 36) *C. signatus* Newst., on guava ;
- 37) *C. tenuivalvatus* Newst., on *Pennisetum purpureum* and *Cymbopogon citratus* ;
- 38) *C. viridis* Green, on coffee and guava ;
- 39) *Eulecanium filamentosum* Newst., on an undetermined plant ;
- 40) *E. somereni* Newst., on mulberry (*Morus*), *Tecoma stans* et *Dolichandrone platycalyx* ;
- 41) *Saussia hemisphaerica* Targ., on ferns and coffee ;
- 42) *S. nigra* Nietn., on coffee, *Ficus* sp. and *A. muricata* ;
- 43) *S. oleae* Bern., on *Chlorophora excelsa* ; parasitised by *Coccophagus sainteubevei* Gir. ;
- 44) *S. subhemisphaerica* Newst., on coffee ;
- 45) *Stictococcus coccineus* Newst., on *Acacia* sp. with *Ceroplastes subcinnabarinus* Newst. ;
- 46) *S. diversuseta* Silv., on *Hybiscus*, *Cajanus indicus*, cacao, *Croton Tiglium*, *A. muricata*, mulberry, *Artocarpus integrifolia* and *Dolichandrone platycalyx* ; preyed on by *Eublemma costimacula* Saalm. ;
- 47) *S. tormicularius* Newst., on *Ficus* sp. ;
- 48) *S. gowdeyi* Newst., on coffee and *Haronga madagascariensis* ; parasitised by *Coccophagus comperi* Gir. and *Epitetrastichus ugandensis* Gir. ;
- 49) *S. multispinosus* Newst., on *Dolichandrone platycalyx* ;
- 50) *Chionaspis cassiae* Newst., on *Cassia floribunda* ;
- 51) *C. dentilobis* Newst., on palms and *Saprum mannianum* ;
- 52) *C. funtumiæ* Newst., on *Funtumia latifolia* ;
- 53) *C. substrata* Newst., on palms ;
- 54) *Diaspis boisduvali* Sign., on *Baikiaea insignis* ;
- 55) *D. regularis* Newst., on *Chlorophora excelsa* ;
- 56) *Aulacaspis chionaspis* Green, on *S. mannianum*, *Erythrina excelsa* and *Cassia floribunda* ;
- 57) *Hemichionaspis chionaspiformis* Newst., on an undetermined plant ;
- 58) *Aspidiotus cyanophylli* Sign., on guava, palms and bananas ;
- 59) *A. cydoniae* Comst., on guava ;
- 60) *A. destructor* Sign., on banana, *Pandanus* sp., guava and mango ; preyed on by *Epilachna punctipennis* Muls. ;
- 61) *A. gowdeyi* Newst., on *Anona muricata* ;
- 62) *A. lataniae* Sign., on palms ;
- 63) *A. transparens* Green, on tea ;
- 64) *Pseudaonidia baikiaeae* Newst., on *Baikiaea* sp. ;
- 65) *Ps. trilobitiformis* Green, on oleander and mango ;
- 66) *Selenaspis articulatus* Morg., on coffee and *F. Thonningii* ;
- 67) *S. silvaticus* Lind., on orange ;
- 68) *Chrysomphalus dictyospermi* Morg., on palms, mango and rose ;
- 69) *Lepidosaphes beckii* Newm. (= *L. citricola* Pack.), on *Citrus* spp. ;
- 70) *L. gloveri* Pack., on *Citrus* and crotons ;
- 71) *Ischnaspis longirostris* on palms, bamboo and coffee ;
- 72) *Gymnaspis africana* Newst., on an undetermined plant.

244 - The Status of Introduced Coccids in South Africa in 1917 (1). — BRAIN, CHAS. K. and KELLEY, ALBERT E., in *Bulletin of Agricultural Research*, Vol. VIII, Pt. 2., pp. 181-185. London, December, 1917

The following list, compiled from data obtained up till August, 1917, during the inspection of the local nurseries, gives the species introduced and established in South Africa. Species, such as *Lecanium bituberculatum* Targ., *L. corni* Bouché, *Pulvinaria betulae* (L.) Sign., *Diaspis rosae* (Bouché), *Aspidiotus piri* Licht. and *A. ostraeformis* Curt., which having been stopped at the ports of entry, could not establish themselves in the country, are not included.

The coccids enumerated are : —

1) *Icerya purchasi* Mask., generally distributed throughout the Union but satisfactorily controlled by *Novius cardinalis*;

2) *I. seychellarum* Westw., Durban (Johannesburg, ex. Durban);

3) *Orthezia insignis* Dougl., Cape Peninsula, Port Elizabeth, East London and Natal Coast. Sporadic in Natal midlands;

4) *Pseudococcus adonidum* (L.) Westw., Cape Town, Port Elizabeth, Durban, Pietermaritzburg, Pretoria and Johannesburg. Chiefly a pot-plant pest;

5) *Ps. aurilanatus* (Mask.), Cape Town, Graaff Reinet, Durban, Pietermaritzburg, Richmond, Johannesburg and Pretoria;

6) *Ps. bromeliae* (Bouché), eastern Cape Province and Natal Coast;

7) *Ps. citri* Russo, prevalent in the Cape Peninsula, but generally confined to nurseries, where it appears to be Dr. MARCHAL's variety *Ps. citri* var. *coleorum*, as *Coleus* is chiefly attacked by it. In the same district it is very rarely found on citrus, being replaced by *Ps. fragilis* Brain; the most common species in vineyards and gardens is *Ps. capensis* Brain; similar conditions exist in Natal, but the citrus species here is *Ps. filamentosus* Ckll.; while the most common species in gardens in Durban is *Ps. virgatus* Ckll.; in Pretoria *Ps. citri* is occasionally extremely abundant on oranges, but, from the majority of citrus orchards, such as those of Rustenburg, etc., the species is apparently absent; the most common species in gardens in Pretoria is *Ps. burmerae* Brain.;

8) *Ps. filamentosus* Ckll., Bathurst, Richmond, Pietermaritzburg (*Citrus*), Pretoria (*Grevillea*);

9) *Ps. nipae* Mask, Cape Town, Graaff Reinet, Port Elizabeth, Uitenhage, Durban, Pietermaritzburg, Johannesburg and Pretoria; found only on palms in greenhouses, except at Durban, where it is occasionally found out of doors;

10) *Ps. sacchari* Ckll., Zululand, Natal Coast and Tzaneen (Transvaal),

11) *Ps. virgatus* Ckll., Durban, Pietermaritzburg and Pretoria (ex Durban);

12) *Tylococcus insolitus* (Green), East London, Kingwilliamstown, and Pietermaritzburg;

(1) See also No 242 of this Review (Ed)

13) *Eriococcus araucariae* Mask., common in the Cape and Natal, and occasionally found in Johannesburg and Pretoria ;

14) *Asterolecanium bambusae*, Bdv., Natal coast and midlands ;

15) *A. variolosum* (Ratz.), Cape Peninsula, Elsenburg, Grabouw, Paarl, Simondium, Irene, Johannesburg, Krugersdorp, Newclare and Canada Junction ;

16) *Cerococcus ornatus* Green, found on one occasion only on stems of *Dovyalis caffra* and *Calodendrum capensis* at Pietermaritzburg ;

17) *Coccus cacti* Goeze, in the Botanic Gardens, Cape Town, where it was introduced many years ago ;

18) *C. confusus capensis* Green, may usually be found where *Opuntia monacantha* is abundant, e. g. in the Cape Peninsula, Albany and surrounding districts, and occasionally in the Orange Free State ;

19) *C. indicus* Green, introduced in 1913 by the Queensland Prickly Pear Commission to destroy *Opuntia monacantha* ; it is now well established in the Cape Peninsula, Komgha, Natal and Pretoria, and was recently received from Mtunzini (Zululand) ;

20) *Lecanium hesperidum* L., widely distributed and common ;

21) *L. elongatum* Sign., Johannesburg and Pretoria ;

22) *Saissetia hemisphaerica* (Targ.), Cape Town, Grahamstown, Durban, Pietermaritzburg, Pretoria and Johannesburg (pot plants) ;

23) *S. nigra* Nietn. (*S. nigrella* King), Bayville, C. P. and Natal Coast (on *Ficus* spp. only) ;

24) *S. oleae* Bern., Cape Peninsula, Ceres, Port Elizabeth, Queenstown, Stellenbosch, Uitenhage, Fort Beaufort, Durban, Pietermaritzburg and Pretoria ;

25) *Protopulvinaria pyrififormis* Ckll., Durban, Pietermaritzburg (ex Durban) ;

26) *Aspidiotus destructor* Sign., Durban and Inchanga (uncommon) ;

27) *Aspidiotus fimbriatus* var. *capensis* Newst., Port Elizabeth (on *Cycas* only) ;

28) *A. (Diaspidiotus) forbesi* Johns., Cradock, Pietermaritzburg, Potchefstroom and Bethlehem ;

29) *A. hederac* (Vall.) Sign., widely distributed throughout the Union and common ;

30) *A. (Hemiberlesea) lataniae* Sign., generally distributed ;

31) *A. (Hemiberl.) rapax* Comst., Johannesburg, Louis Trichardt and Pretoria ;

32) *A. (Diaspidiotus) perniciosus* Comst., in most centres an attempt has been made to eradicate this insect as soon as discovered ; it has been reported from : — Estcourt, Frere, Hilton Road, Ladysmith, Moorleigh, Newcastle, Pietermaritzburg, Utrecht, Vryheid, Weenen, Winterton, Dundee and Richmond, in Natal ; Amersfoort, Benoni, Bethal, Boksburg, Boskop, Bronkhorstspuit, Cullinan, Heidelberg, Johannesburg, Middelburg, Nylstroom, Pretoria, Rayton, Scheerpoort, Standerton and Witbank, in the Transvaal ; Kroonstad and Viljoen's Drift, in the Orange Free State ;

- 33) *A. transparens* Green, Natal Coast ;
- 34) *A. (Selenaspidus) articulatus* Morgan, Durban and Pietermaritzburg ; an uncommon scale ; the most common species of *Selenaspidus* is *S. silvaticus* Ldgr. ;
- 35) *Chrysomphalus aurantii* Mask., widely distributed throughout the Union ;
- 36) *Chrys. dictyospermi* Morgan, Cape Town, East London, Kimberley, Kingwilliamstown, Durban, Pietermaritzburg, Barberton, Johannesburg, Nelspruit and Pretoria ; this species is common only in greenhouses, and though it has been found on rose and peach, it has not yet been recorded on citrus in the Union ;
- 37) *Chrys. ficus* Ashmead, common in orchards on the Natal Coast and in a few districts in the Transvaal (Warmbaths, Rustenburg and Nelspruit) ; a greenhouse pest along the Cape and Natal Coasts, and also at Queenstown, Pietermaritzburg, Johannesburg and Pretoria ;
- 38) *Chrys. rossi* Mask., Cape Town (reported but not well established here), East London, Grahamstown, Queenstown (as for Cape Town), Estcourt, Dundee, Durban, Pietermaritzburg, Johannesburg, Pretoria, Krugersdorp, Pietersburg, Bloemfontein ;
- 38\*) *Chrys. rossi* var. *greeni* n. var., East London and Durban on native trees (uncommon) ;
- 39) *Morganella maskelli* (Ckll.), established at Durban on a number of different host plants ; reported from Pietermaritzburg ; on citrus at Hillary ;
- 40) *Diaspis boisduvali* Sign., Durban, Pietermaritzburg and Pretoria (uncommon) ;
- 41) *D. biomeliae* (Kern), Natal Coast, Kingwilliamstown and Pretoria ; uncommon, chiefly in greenhouses ;
- 42) *D. echinocacti* (Bouché), Graaff Reinet and Pearston, C. P. and other places in the Karroo ;
- 43) *D. (Aulacapsis) pentagona* Targ., common in the Western Province of the Cape and in most of the other large towns in the Union ;
- 44) *Pseudaonidia trilobitiformis* Green ; Hillary (Durban) on Litchi (*Nephelium Lit-chi*) (probably ex Mauritius) ;
- 45) *Parlatoria pergandei* Comst., Cape Town, Grahamstown, Port Elizabeth, Durban, Johannesburg and Pretoria (in greenhouses) ;
- 46) *P. protius* Curt., Durban (in greenhouses, uncommon) ;
- 47) *P. zizyphi* Lucas, in several orchards near Durban ; not common ;
- 48) *Chionaspis simplex* Green. var., Durban (on bamboo) ;
- 49) *Pinnaaspis aspidistrae* Sign., common in greenhouses ;
- 50) *Fiorinia fioriniae* Targ., Cape Town, Graaf Reinet, Grahamstown, Port Elizabeth, Uitenhage, Durban, Hillary, Inchanga, Johannesburg (ex coast) ; in greenhouses ;
- 51) *Howardia biclavis* Comst., Durban ;
- 52) *H. moorsi* Doane and Ferris, Durban Botanic Gardens ;
- 53) *Lepidosaphes pinniformis* Bouché, Cape Peninsula, Port Elizabeth, Uitenhage, Stellenbosch, Somerset West, Bathurst, East London

District, Natal Coast, Cape Town, Greytown, Piet Retief, Pietermaritzburg, Barberton, Nelspruit (in citrus orchards); Cape Town, Durban, Pietermaritzburg, Uitenhage, Johannesburg (in greenhouses, chiefly on croton [*Codiaeum*] and *Murraya*);

54) *L. gloveri* Packard, Port St. Johns and in four orchards of the Cape Peninsula, Stanger and Warmbaths;

55) *Ischnaspis longirostris* Sign., East London, Port Elizabeth, Durban, Hillary (Pretoria and Johannesburg, probably ex Durban), occurs on a number of ornamental plants; at Warmbaths on citrus.

245 - The Fluted Scale (*Icerya purchasi*). — SPEYER, F. R., in *Department of Agriculture, Ceylon, Leaflet No. 3*. Colombo, Ceylon, March, 1917.

So far as is known India is still free from attacks of this dreaded insect. The island of Ceylon was also considered to be immune till, in December, 1915, the insect was discovered on *Acacia decurrens* on an estate in the Agradipatnas (Central Province). It was, immediately after, reported from another estate in the same district, again on *A. decurrens*, and was found at Paradeniya on numerous specimens of *Casuarina*, one of which was seriously attacked. In August, 1916, an *Acacia* forest in Ambawela was attacked by large numbers, which, in October, were exceeded on the estates in the Agradipatnas. The insect was also found on *A. dealbata*. It was next noticed that acacia plants served as hosts to the scale in the districts of Galaha and Upper Hewaheta, and two females were found on a citrus in the first of these districts. Reports from Kandy show that, though other plants may be attacked, acacia is the centre of infection.

Apart from the damage which may be done to fruit trees and the temporary weakening of the acacias, as a result of the holes made by the insect, there are other plants in the island which it is important to protect from its attacks.

Although controlled by a fungus, *Cephalosporium*, during the north-east monsoon in the districts of Ambawela, Hewaheta and Galaha, and, it seems, before this monsoon in the Agradipatnas, the insect increases very greatly during the other periods. There are native lady-birds which feed on the scale at Paradeniya and at Ambawela, but, at present, they are few in number. The chances of its spontaneous natural extermination are small, and for some time yet an increase is to be expected.

To control the pest before it touches economic products, a full knowledge of its distribution is urgently required. It may still be sufficiently localised for radical extermination to be possible. If it be more widely distributed, radical extermination might be used in the worst centres, while lady-birds imported from South Africa or Australia could be distributed to all outlying localities with a view, at least, of keeping the scale within bounds.

246 - Observations on *Lepidiota frenchi* Black, A Sugar Cane Pest in Queensland (1). — JARVIS, EDMUND, in *Queensland Bureau of Sugar Experiment Stations, Division of Entomology, Bulletin No. 5*, pp. 1-14, 1 pl. Brisbane, 1917.

Although rather less injurious to sugar cane than the grey-back cockchafer (*Lepidiota albohirta* Water) (2), *L. frenchi* Black may, from an

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

(1) See also B. August, 1915, No. 874; R. Sept., 1916, No. 1048. — (2) See also R. Dec., 1916, No. 1343. (Ed.)

economic point of view, be considered as holding second place among the Scarabaeidae which attack this crop in northern Queensland.

The coleopteron, which normally lives at the expense of the root system of the native cereals and other herbaceous plants, shows a marked preference for sugar cane. An invasion of the insect, the importance of which is worthy of note, was reported at Meringa (District of Cairns) in April, 1917. While ploughing red volcanic soil there were collected from 50 chains of furrow, within a few hours only, 186 larvae of the second stage, representing 2 418 larvae per acre, *i. e.* an average of 0.85 per stool of cane.

Considering the affinity between *L. franchi* and *L. abohiria*, the excessive abundance of the insect in question, its varied diet, its frequent appearance in sugar cane plantations and its preference for this plant, the author has collected in his paper the observations made up to the present on the life cycle of the insect and its habits.

247 - Common Pests of Fruit Trees in Ontario, Canada. — CAESAR, LAWSON, in Ontario Department of Agriculture, Ontario Agricultural College, Bulletin 250, pp. 1-55, figs. Toronto, Ontario, July, 1917.,

No attempt is made in this bulletin to discuss all the insect pests of fruit trees, but only the most common and the most to be dreaded economically. The description of each insect is followed by information concerning its biology and the most efficacious means of control.

APPLE TREE. — Codling moth (*Carpocapsa pomonella* L.); Lesser apple-worm (*Enarmonia prunivora* Walsh); Apple maggot (*Rhagoletis pomonella* Walsh); Fruit-tree leaf-roller (*Tortrix argyrospila* Walker; San José scale (*Aspidiotus perniciosus* Comstock); Oyster-shell scale (*Lepidosaphes ulmi* Bouché); European grain aphid (*Aphis avenae*); Rosy aphid (*A. [sorbi] malifoliae*); Apple leaf-aphid (*A. pomi*); Woolly aphid (*Eriosoma lanigera* Hausmann); Mirids or leaf-bugs (*Heterocordylus malinus* Reuter, *Lygidea mendax* Reuter, *Neurocolpus nubilus* Say and *Paracalocoris colon* Say); Apple tent-caterpillar (*Malacosoma americana* Fabricius); Forest tent-caterpillar (*M. disstria* Hubner); Fall canker-worm (*Alsophila pomataria* Harris); Spring canker-worm (*Paleacrita vernata* Peck); Bud-moth (*Tmetocera ocellana* Schiffermüller); Cigar case-bearer (*Coleophora fletcherella* Fernald); Pistol case-bearer (*C. malivorella* Riley); Green fruit-worms (*Xylina* spp.); White-marked tussock-moth (*Hemerocampa leucostigma* Smith and Abbott); Fall web-worm (*Hyphantria cunea* Drury); Buffalo tree-hopper (*Ceresa bubalus* Fabricius); Round-headed apple-tree borer (*Saperda candida* Fab.); Plum curculio (*Conotrachelus nemophar* Herbst.); Red spider (*Tetranychus pilosus* [*T. mytilaspidis* Riley?]) Fruit-tree bark-beetle or shot-hole borer (*Eccoptogaster rugulosus* Ratzeburg).

PEAR TREE. — Pear psylla (*Psylla pyricola* Forester); Pear slug (*Eriocampoides limacina* Retzius); Pear-leaf blister-mite (*Eriophyes pyri* Pagenstecher); *Carpocapsa pomonella*; *Xylina* spp.; *Tmetocera ocellana*; *Coleophora fletcherella*; *Tortrix argyrospila*; *Hemerocampa leucostigma*; *Hyphantria cunea*; *Malacosoma americana*; *M. disstria*; *Aspidiotus perniciosus*; *Lepidosaphes ulmi*; *Eccoptogaster rugulosus*.

PLUM TREE. — *Conotrachelus nenuphar*; *Tetranychus pilosus* (*T. mytilaspidis* ?); *Xylina* sp.; *Tmetocera ocellana*; *Coleophora fletcherella*; *Tortrix argyrospila*; *Alsophila pometaria*; *Paleacrita vernata*; *Hemerocampa leucostigma*; *Malacosoma americana*; *M. disstria*; *Ceresa bubalus*; *Aspidiotus perniciosus*; *Lepidosaphes ulmi*.

CHERRY TREE. — Cherry fruit-flies (*Rhagoletis cingulata* Loew and *R. fausta* Osten Sacken); Cherry aphid (*Myzus cerasi* Fabricius); *Eccoptogaster rugulosus*; *Tmetocera ocellana*; *Tortrix argyrospila*; *Alsophila pometaria*; *Paleacrita vernata*; *Malacosoma americana*; *Ceresa bubalus*; *Aspidiotus perniciosus*; *Eriocampoides limacina*; *Conotrachelus nenuphar*.

PEACH TREE. — Peach-tree borer (*Sanninoidea exitiosa* Say); *Sesia pictipes* Grote and Robinson; *Xylina* spp.; *Tmetocera ocellana*; *Malacosoma americana*; *M. disstria*; *Aspidiotus perniciosus*; *Conotrachelus nenuphar*; *Eccoptogaster rugulosus*.

248 - **Three-Lined Fig-Tree Borer.** — HORTON, J. R., in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 371-382, pl. 35-37. Washington, D. C., November 19, 1917.

The adult three-lined fig-tree borer (*Ptychodes trilineatus* L.) does considerable damage to fig-trees (*Ficus Carica*) in the south of the United States from Florida to Houston, Texas, and from South Carolina to the Gulf. It has also been reported from parts of Mexico, British Honduras, Nicaragua, Costa Rica, Guatemala, Panama, the West Indies, Columbia, Venezuela, and Tahiti.

The adult causes some injury by feeding on the fruit, leaves and bark of the trees, and by ovipositing in the bark, but the greatest amount of damage is done by the larva. The larva mines into the larger branches and trunks of the trees and feeds upon the wood for a period varying from three months to a year. The insect lives both in dry and in green wood, and specimens have lived for two or three weeks in wood other than fig. It appears to prefer partly dead wood which has lost some of its sap to healthy green wood, and, therefore, chiefly attacks trees or branches which are injured or diseased.

A detailed description of the life-cycle and habits of the borer is given.

As the adult does not, as a rule, lay its eggs in the perfectly sound limbs or trunks of the healthy trees, it is most important to keep the trees in the healthiest condition possible. The larger branches and trunk are the parts particularly susceptible to attack. Bruising the bark, breaking the limbs, and all kinds of disease should be carefully guarded against. If a branch be accidentally broken it should be cut off at its base immediately and the wound painted several times with a mixture of coal-tar and creosote. Infested branches should be cut off and burnt, as the borers will complete their development even in perfectly dead wood, and, later, attack other trees. Prunings should be destroyed and never left in or near the orchard. Frozen branches should be cut off, diseased or bruised bark removed, and the wounds suitably painted.

Trees heavily infested in the bark, which can no longer be saved,

should be cut down, and every scrap burnt. The same should be done with badly damaged or dying trees, and the shoots which spring up from the roots of old fig trees.

In certain cases the eggs may be dug out with a knife or an awl; in this case it is necessary to be able to recognise the egg punctures and eggs. In small orchards ovipositing may be largely prevented by protecting the trunk and larger branches with wire-netting, which should be left on all the year. In some cases the borers may be killed by injecting carbon bisulphide into the tunnels and plugging the openings with putty, but this method is impracticable when infestation is severe and well advanced.

249 - *Oscinosoma discretum*, a Dipteran Observed in the Fruit of Wild Figs, in Italy. — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 147-151, figs. 1-1X. Portici, 1917.

While studying another dipteran — *Lonchaea aristella* Beck. — the author frequently found in the flowers of the wild fig tree, eggs and larvae of *Oscinosoma discretum* Bezzi in litt. (fam. Chloropidae). He describes the life history of this species, observed hitherto near Portici and Resina (province of Naples), so that it may be distinguished from *L. aristella* and the larvae of other diptera attacking the fruit of the wild fig.

The insect lays its eggs under the scales of the eye of the ripe flowers and, though rarely, in the ripe second-figs, by placing them horizontally as does *L. aristella*. In one fruit may be found numerous eggs — more than 100 — of *O. discretum* alone or together with those of *L. aristella*. The newly-hatched larvae penetrate to the inside of the fruit and feed on the remains of the decomposing flowers and on the parenchyma of the wall of the fruit itself. When fully developed they leave the flower, which has usually fallen to the ground and pupate a few inches below the surface. Like *L. aristella* this species takes about 20 days to develop from the egg to the adult stage.

Although the eggs and larvae of *O. discretum* were abundant in the ripe flowers in June and July, 1917, and all the pupae produced perfect insects at the end of July or beginning of August, neither the eggs nor larvae of the species were found in many figs of the wild tree, during the rest of August. It was only on the 4th. September that the author found a few eggs of *O. discretum* in ripe second figs picked near Resina, whereas, in the same second figs, larvae of *L. aristella* were present in enormous quantities. So far, the author has never found eggs of *O. discretum* in figs of the good varieties, and, having found the eggs and larvae of the dipteran only in the flowers and ripe second figs, he doubts whether this variety lives normally in any other way. This must be settled by later studies; for the moment it is certain that *O. discretum* exists in abundance in the ripe flowers in June and July.

[248-249]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

250 — **The Agricultural Wealth of the New Hebrides.** — LARGBEAU, T. (President of the French Agricultural Syndicate of the New-Hebrides), in the *Revue agricole, Organ de la Chambre d'Agriculture de la Nouvelle Calédonie*, No. 54, pp. 31-52. Noumea, 1917.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

The chief crops of the New Hebrides are *coffee*, *cacao*, *copra*, *cotton* and *maize*. Under present conditions these are the only remunerative ones. *Kola*, *vanilla*, *pepper*, *spices* of all kinds, *manioc*, the most varied *textiles*, *rice*, *sorghum*, *banana*, etc., yield as good crops as elsewhere, but the quality of the labour and economic reasons, do not, for the moment, allow these to be grown advantageously.

This, however, does not apply to *coffee* of which the hardy species recently imported from the Congo through the Botanical Garden of Java, give great promise.

*Cacao*, of which large plantations were formed when hemileia made its appearance in 1913, has given remarkable results. The cacao of the New Hebrides is in no way inferior in theobromine and butter content to any of the best varieties on the European markets.

For the moment *copra* holds the first place in commercial value among the products sent from the New Hebrides.

*Cotton* gives excellent results both in quality and yield, but growers seem to be taking less and less interest in this crop which requires much labour for picking. Certain estates which were under favourable conditions in this respect have made very large profits.

*Maize*, although satisfactory, will never be grown to any but a limited extent on account of heavy freight and the few markets available.

*Sandal-wood* grows wild in certain parts of the islands. For four years it has been subjected to intensive cutting, which, in view of the impossi-

bility of regulation, shows it will be ruined before long. There are other valuable woods which are not exploited owing to lack of labour and capital.

The following table shows the comparative value of the agricultural products exported from the New Hebrides from 1914-1916.

	1914			1915			1916		
	lbs.	£.	s. d.	lbs.	£.	s. d.	lbs.	£.	s. d.
Cacao . . . .	97 231	3107.17.	5	173 652	5621. 8.	2	9504 774	19063.17.	5
Coffee . . . .	331 841	10742. 5.10		833 851	26994. 4. 7		3594 079	19231. 8. 7	
Copra . . . .	7 349 185	66085.10. 8		9 017 252	81082.13.11		3 184 332	82600. 8. 3	
Cotton . . . .	1 524 036	13701. 4. 3		3 486 131	31347.17. 5		862 302	34730. 7.10	
Maize . . . .	1 025 235	22593 11. 0		3 333 965	8994. 8. 4		412 756	7582. 8. 9	
Sandal-wood .	225 869	2813. 9. 0		236 339	2989.16. 0		301 790	4345.10. 2	
Total.	—	119076.14.11		—	157032. 8. 5		—	167554. 1. 0	

Almost all the exports rise from year to year, and there will be a considerable increase in 1917.

It should be noted that all these results were obtained in spite of the lack of agricultural instruction, with most primitive tools and without the aid of agriculturists and chemists as is the case in other countries. Under present conditions, if there is sufficient labour, it may be estimated that, in 1920, the products will amount to: — 1 500 metric tons of cacao, 6 000 of copra, 1 000 of coffee, 3 000 of cotton and 2 000 of maize, without counting other produce, such as shells and costly woods.

#### RURAL HYGIENE

251 — *Gambusia affinis*, a Small Fish Very Useful for the Destruction of Mosquito Larvae. — RAVERET-WATTEL, C., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year L, XIV, No. 12, pp. 445-451. Paris, December, 1917.

*Gambusia affinis* Baird and Girard is a very small fish (the largest specimens rarely attain a length of 5 cm.) belonging to the family Cyprinodontidae, which closely resemble Cyprinidae in outward appearance, but are differentiated by several characters, notably the presence of teeth; many of them are ovoviviparous, as is the genus *Gambusia* (1).

The Gambusias are of no value as food, but are of great utility as their food consists almost wholly in mosquito larvae, of which they destroy great numbers. They are the best fish as destroyers of mosquitoes as they live at the surface of the water (whence the name of "top minnows", given in the United States) and they can live in water so shallow as to be uninhabitable for other species; large numbers of this fish are often found in ponds where the mud is, at times, only covered by 3 cm. of water.

The fish breed easily, on account of their hardiness and the fact that, as they are born in an advanced state of development, they are less exposed to various dangers. Experiments made in New Jersey have shown that not only are they easy to breed, but they constitute a hitherto neglected means for controlling mosquitoes wherever the water is sufficiently warm.

(1) The name of *Gambusia* is derived from "Gambusina", a Cuban word meaning a very small or worthless object. (Author).

252 - **The Digestibility of the Dasheen.** — LANGWORTHY, C. F. and HOLMES, A. D., in U. S. Department of Agriculture, *Bulletin* No. 612, pp. 11. Washington, November 8, 1917.

The dasheen and other varieties of the taro (*Colocasia esculenta*) was till recently very little known in the United States, but of late the Department of Agriculture has given much attention to the selection of varieties suited to warm districts where the potato does not do well.

The edible part consists of a large central root, which may weigh from 1 to 5 lbs., or even more, and by numerous small tubers about the size of sweet potatoes. The dasheen may be cooked in several ways, like the potato, and has a pleasant flavour. As the literature on the subject gives no information on the digestibility of this food, the Department of Agriculture carried out feeding experiments on strong, healthy men on a simple, but mixed diet. The results were : —

*Digestibility of the Dasheen.*

	Protein	Fat	Carbo- hydrates	Ash
Unripe roots and tubers (average of 6 experiments). . . . .	79.9 %	96.2 %	97.5 %	79.4 %
Ripe roots and tubers (average of 10 experiments). . . . .	80.8	96.1	97.6 %	78.4

The average amount of food eaten daily per subject in all the experiments was 1733.4 gm., giving 1313.6 gm. of water, 41.2 gm. of protein, 129.4 gm. of fat, 230.6 gm. of carbohydrates and 18.6 gm. of ash. The amount of dasheen eaten per man per day varied from 376 gm. to 731 gm. with an average of 547 gm. In no case did such large quantities of dasheen cause physiological disturbances. The results show that the carbohydrates of dasheen, which form one of its principal constituents, have a digestibility which may be compared with that of the potato (99.0 % according to BRYANT and MILLER, 92.4 % according to RUBNER, 99.6 % according to CONSTANTINIDI). There is no perceptible difference between the digestibility of ripe and unripe dasheen. In conclusion, it may be said that dasheen forms an excellent food.

253 - **Hygienic Disadvantages of Using Lime in Breadmaking.** — See No. 344 of this *Review*.

254 - **Studies and Investigations of the Imperial Institute, London (1).** — *Bulletin of the Imperial Institute*, Vol. XV, No. 2, pp. 177-184, 198-270. London, April-June, 1917.

PRODUCTION AND USES OF RICE. — An article on the cultivation and preparation of rice was published in previous numbers of the *Bulletin of the Imperial Institute* (Vol. XI, p. 634, 1913; Vol. XII, p. 85, 1914), in which the varieties of rice, methods of cultivation and preparation, pests and diseases, were described and an account given of the production of this cereal in the British Empire. The article under review deals with the production

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

(1) See also R. January, 1918, No. 5. (*Ed.*)

and commercial movement of rice, especially in the British Empire, and the use of rice and its derivatives.

The production of rice, as shown by official estimates, for nearly all the rice-growing countries is given in the appended table. The chief omission is China, for which figures are not available.

*World's production of rice.*

Country	Production (cleaned rice) tons	Country	Production (cleaned rice) tons
India *		Bokhara and Khiva <sup>14</sup>	40 000
British India (1916-17) . . . .	34 079 000	Persia . . . . .	250 000
Native States . . . . .	1 000 000	Mesopotamia <sup>1</sup> . . . . .	30 000
Ceylon ** (1915) . . . . .	172 000	Siam <sup>1</sup> . . . . .	2 500 000
Malaya ** . . . . .		Dutch East Indies ** . . . .	
Straits Settlements. . . . .	35 000	Java and Madura (1914) . . .	3 494 000
Federated Malay States (1913)	46 000	Sumatra, etc. . . . .	750 000
Kelantan . . . . .	35 000	French Indo-China * . . . .	3 500 000
Perlis. . . . .	7 000	Japan (1916) . . . . .	8 177 000
British North Borneo ** (1914-15)	9 800	Korea * (1916) . . . . .	1 758 000
Hong Kong ** . . . . .	15 000	Formosa * (1914) . . . . .	647 000
Fiji ** . . . . .	9 000	Philippines ** (1915) . . . .	491 000
Egypt ** (1914-15) . . . . .	366 000	Madagascar * . . . . .	450 000
Uganda ** . . . . .	100	United States <sup>11</sup> (1916) . . . .	520 600
Nyasaland (1916) . . . . .	1 300	Mexico ** (1914) . . . . .	15 000
British Guiana * (1915) . . . . .	41 000	Guatemala ** (1916) . . . . .	7 500
Trinidad ** . . . . .	1 700	Dutch Guiana ** (1914) . . . .	3 000
Italy * (1916) . . . . .	320 000	Ecuador ** (1917) . . . . .	15 000
Spain * (1916) . . . . .	149 000	Peru ** (1915-16) . . . . .	40 000
Bulgaria ** (1912) . . . . .	3 000	Brazil * . . . . .	250 000
Greece ** . . . . .	1 200	Argentina ** (1916) . . . . .	7 000
European Russia ** (1913) . . .	256		
Transcaucasia and Russian Tur-		<i>Approximate World's total (for</i>	
kestan ** (1914) . . . . .	170 000	<i>countries listed) . . . . .</i>	<b>59 407 000</b>

\* Exporting countries, in which production exceeds consumption.

\*\*Importing countries, in which consumption exceeds production. It is doubtful to which category the countries without any mark belong.

**TAPIOCA STARCH FROM RHODESIA.** — Cassava or manioc (*Manihot utilissima*), from the roots of which tapioca and tapioca starch are prepared, has been grown for several years at the Agricultural Experiment Station, Salisbury, Rhodesia. The plant does very well there. The roots when fed to stock produced no ill effect. Some of the starch, prepared experimentally at Salisbury was sent to the Imperial Institute to be examined; it gave the following analysis: —

Moisture 14.4 %; proteins 0.1 %; fat 0.15 %; starch 82.8 %; ash 0.2 %; fibre and matter soluble in water, nil.

A firm of importers stated it to be of good quality and valued it at £ 28 per ton, ex quay Liverpool. Another firm considered it of medium quality and valued it at £ 20 to £ 25 per ton, delivered in Dundee.

**THE LIME FRUIT IN NIGERIA.** — The lime tree (*Citrus medica* var. *acida*) occurs in most parts of British West Africa, and in some places has become naturalised. The fruit is used to some extent locally for the preparation of lime juice, but there is no export trade in either the fruit or its products.

The possibility of utilising the fruit has been investigated by the Government Chemist at Lagos, who sent to the Imperial Institute for examination fresh fruit, distilled oil of limes, and a sample of citrate of lime. The fruit was found rather small ( $1\frac{3}{8}$  to  $1\frac{5}{8}$  inches in diameter), but sound and of good quality. There is a very small demand for them on the English market. Analysis showed them to contain : —

Percentage of juice to fruit . . . . .	57.4
Total solids in juice . . . . .	10.6 gm. per 100 cc.
Citric acid in juice . . . . .	8.2 gm. per 100 cc.
Purity of juice (ratio of acid to total solids) . .	77.0
Percentage of citric acid in entire fruit . . . . .	4.4

To prepare the oil with the ripe fruit, the juice, skin and pulp are distilled in steam separately and the distillates mixed. The average yield was 0.17 % of the whole fruit. The oil, of a pleasant odour and good quality, was similar in character to the Italian oil distilled from *Citrus Limetta* : —

Specific gravity at 15° C., 0.8946; optical rotation at 20° C., + 34°4'; refractive index at 21° C., 1.4815.

The citrate of lime was prepared from the concentrated lime-juice in the ordinary way. The yield of juice varied from 6 to 7 fluid oz. per lb. of fruit, and the yield of citrate from 0.55 to 0.6 oz. per lb. of fruit. The sample examined contained : —

Moisture 4.9 %; citric acid 70.6 %; calcium carbonate 1 %.

It was stated to be of excellent quality and certain of a ready sale.

**PISTACHIO NUTS AND THEIR CULTIVATION.** — The pistachio tree (*Pistacia vera*, Linn.) a native of Syria and Persia, is cultivated throughout the sub-tropical Mediterranean region, as well as in the Caucasus and in several parts of western Asia. Its climatic requirements are similar to those of the olive. In its original habitat it may occur at altitudes of 3 000 feet. It prefers light soil, but will grow well in any that is not too damp. It is resistant to wind and can withstand a few degrees of frost in winter, but requires a high summer temperature in order to fruit plentifully. It is commonly held to yield a good harvest only in alternate years. It gives the best results in Tunis, and especially in Sicily, where, in view of the rapidity of its growth, it might be much more widely cultivated than it is. It may be propagated by sowing, grafting or budding. Budding is the most common method, as by this means the tree may bear fruit after 2 or 3 years. Plants grown from seed only bear fruit after 6 or 8 years, and, as the tree is a dioecious Anacardiaceae, it is impossible to foresee whether it will be productive (female). About  $\frac{1}{10}$  of the plants are male. Grafting is carried out on other species of *Pistacia*, giving more resistant trees which

do well where *P. vera* from seed would not succeed ; thus, grafted on *P. Terebinthus* (grown from seed), it will give plants that will bear fruit in Central France. Once established, the pistachio needs little attention, but fertilisation must be assured. As a rule one male tree is required to every 4 or 6 female trees, and the distance between a male and female tree should not exceed 20 yards. A male graft may be grown on a female tree, or buds from both kinds of trees inserted in the same stock.

It is probable that the cultivation of the pistachio could be considerably extended. It grows readily in Cyprus, where it is commonly budded or grafted on *P. Terebinthus* and *P. Lentiscus* but does not produce well owing to the scarcity of male plants. In the East the fact that the plant is dioecious is not sufficiently appreciated. The tree could probably be grown in India, and its cultivation might be successful in the southern hemisphere, for instance in Australia and South Africa.

Pistachio nuts are an important article of commerce ; the imports into France (mainly from Russia and Turkey) in 1913, were 4 280 cwt., and the exports were 3 517 cwt., 1 982 of which went to the United States, the total value being £ 42 888. The composition of the kernel is : —

Water 7.4 % ; crude proteins 22.7 % ; fat 51.1 % ; carbohydrates 13.0 % ; cellulose 2.5 % ; ash 3.3 % ; food units 197.5.

The oil extracted from the kernels has the following constants : —

Specific gravity at 15° C. 0.9185 ; saponification value 191.0-191.6 ; iodine value 86.8-87.8 % ; solidifying point of fatty acids 13-14° C.

**WAX FROM *Ceroxylon andicolum*.** — This palm occurs only in western tropical South America, where it is very abundant. The wax, obtained from the leaves, is used in Colombia for making candles, but has not yet been exported. A sample of fine powdered wax of a pale straw colour examined at the Imperial Institute, and the wax obtained after purification, showed the following composition and characters : —

Moisture 1.5 % ; ash 0.6 % ; wax 92.0 % ; dirt (matter insoluble in carbon tetrachloride) 6.5 % ; specific gravity at 15° C. 1.018 ; acid value 19.8 ; saponification value 73.7-104.4 ; iodine value 32.8 % ; melting point (open tube method) 93° C.

The purified wax is similar in character to carnauba wax (*Copernicia cerifera*), which is obtained chiefly from Brazil, and the candelilla wax (*Euphorbia* sp.), imported from Mexico, but has a higher melting point (that of the two others is 84° C. and 70-72° C. respectively). It would be readily saleable at about the same price as these two waxes, which before the war, fetched from £ 5 to £ 9 per cwt. in the United Kingdom.

The wax must be purified before export. The following method is recommended by the Imperial Institute. The crude wax-dust is placed in a canvas or calico bag and immersed in boiling water, the bag being weighted to keep it below the surface. The melted wax rises to the surface, where it is allowed to cool. When cold, the wax is powdered and dried. It is then melted at a gentle heat (not more than 110° C. and not longer than necessary), allowed to solidify and the lower dark layer cut away, and either sold separately or repurified with the next batch.

- 255 — **Electrical Stimulation of Crops.** — BIRKS, L. and DAVIS, O' D., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, pp. 185-190, 2 figs. Wellington, October, 1917.

New Zealand possesses large supplies of hydro-electric power and is in a particularly favourable position to apply this power to cultivation. Preliminary experiments have been made at Christchurch. The first was carried out in a greenhouse 80 feet  $\times$  30 feet in which 1 400 tomato-plants were set out. The house was fitted with lamps, hung 2 feet from the ground, which were kept alight from 9 p. m. till 5 a. m. As the plants grew the lamps were raised, until they were finally covered by the tops of the plants. At the beginning of the experiments the steam-pipes had gone out of order and many plants had been injured by a severe frost before the heating apparatus could be repaired. The plants recovered rapidly and gave a very heavy crop, ripening relatively earlier than those of another glasshouse, where the plants, which were not attacked by frost, were grown under similar conditions but without lighting at night.

A second experiment was carried out to test the possibility of protecting fruit trees against frost by means of 250-watt radiator lamps suspended in the centre of the tree, near the fork, and turned on during the nights when frost was to be feared. Three rows of 8 trees each were used for the experiment, one of pear-trees and two of mixed apples. The radius of action of the heat of the lamp was found to be approximately 1 ft. below the lamp, 4 ft. above it, and 3 ft. all round it horizontally. There were many frosts, two of which were very severe. Electric heating did not appear to have any effect on the pear-trees, but the apple-trees gave a heavier crop and ripened fully a fortnight earlier than those which were not heated by electricity.

The cost of installing electricity for stimulating crops in glasshouses is not prohibitive, working out at about 10 to 20 % of the actual present capital and interest and depreciation cost of the glasshouse. The use of electricity for stimulating plant growth would be very valuable, especially for early crops.

## CROPS AND CULTIVATION.

- 256 — **The Problem of Agricultural Meteorology** (1). — AZZI, G., in *Bollettino del Ministero di Agricoltura, Industria e Commercio*, Series B., pp. 1-10. Rome, 1916, and in *Bollettino bimensuale della Società Meteorologica Italiana*, Series III, Vol. XXXV, Nos. 6-7-8, pp. 25-32; Nos. 9-10, pp. 39-42. Turin, 1917.

AGRICULTURAL  
METEOROLOGY

THE PRINCIPLES NECESSARY TO THE SOLUTION OF PROBLEMS OF AGRICULTURAL METEOROLOGY. Among the variations in the yields of crops those caused by atmospheric changes hold the first place. These changes are of

(1) In March, 1911, the general Meeting of the\*Delegates of the States adhering to the International Institute of Agriculture received favourably the proposal of Mr. L. OUIS DOP (French Delegate and Vice-President of the Institute) with regard to the international organisation of agricultural meteorology, and decided to send officially the report to the President of the International Committee of Meteorology.

In September, 1912, at a meeting of the Central Meteorological Bureau, Mr SHAW, Presi-

far greater importance than those due, for example, to the use of fertilisers, to cultivation, etc. For this reason studies aiming at reducing the damage done by meteorological factors deserve the greatest attention. The author has drawn up a very detailed scheme which permits the damage caused by weather to be reduced with certainty, by favouring a more rational adaptation of the various crops to the climates of the different districts.

Three principles are required for the solution of problems of agricultural meteorology: — 1) a knowledge of the critical period; 2) phenological maps; 3) weather charts.

*Critical period.* — From germination to harvest the plant undergoes great modifications which change its form and structure, so that its requirements, even with regard to the various meteorological factors, vary during the growing period.

The critical period with regard to "rain" is the interval, more or less long, of the growing period during which the plant has an absolute need of a certain minimum quantity of water. If, during the critical period, the total rainfall is below the minimum required for the normal growth of the plant, the harvest will be poor, even though there be abundant rain during the rest of the growing period, and, inversely, if during the critical period, the needs of the plant are satisfied, the harvest will be plentiful, even though the rainfall during the rest of the growing period be scarce and badly distributed.

The critical period of cereals falls during the twenty days preceding earing. If, at this moment, there is not sufficient rain to keep the moisture of the soil above a certain limit, the grain harvest will be seriously compromised.

What has been said for rain may be repeated for all the other factors. A plant may, therefore, have more than one critical period, those of rain, frost, temperature, clouds, etc. One or all of these periods may assert itself and assume importance according to the local conditions of the climate.

The necessity of a detailed physiological and meteorological examination is thus obvious when it is desired to ascertain with exactitude in each district the cause of a failure in the crops and the requisite remedies.

*Phenological maps.* — In a certain number of stations in different parts of Italy the average date is calculated when the peach, for example, flowers, and the data obtained is marked on the map at points corresponding to the various stations. All the districts, in which flowering occurs in the same decade are included in one zone and the various zones marked in different colours. This gives the phenological map of the flowering of the peach tree.

The critical periods referred to above always coincide with some phase of growth (flowering, earing, etc.), that is to say, to a moment when the

ment of the International Committee of Meteorology, formed a commission of 5 members who drew up a scheme of work to be submitted to the International Committee of Meteorology. The commission, on which were placed other technical specialists, should have met in December, 1914. The war interrupted its work. (See B. Dec. 1912, No. 1605).



plant undergoes great modifications which make it very sensitive to the lack of rain or to other unfavourable meteorological phenomena. Thus, at the flowering stage of fruit trees, a drop in the temperature, which at other moments of growth would have no effect, suffices to compromise seriously the fruit crop.

If the average date of the different stages in the growth of a plant (leafing, flowering, ripening of the fruit) are known, it is possible to determine the period of the year during which the plant is particularly sensitive to the harmful action of certain phenomena, or particularly exacting with regard to humidity, temperature, etc. Thus, if the average date of flowering of the peach tree at a station A is February 5, the critical period of that tree with respect to frost will be the first 10 days of February. The phenological maps, then, make it possible to determine the critical period. For each variety grown there should be as many phenological maps as there are important stages of growth in relation to weather. For cereals these are: 1) germination; 2) earing; 3) flowering; 4) ripening of the grain.

*Weather charts.* — In 1910, in the province of Bologna, there was no rain during the 20 days preceding earing, which took place on May 15; and the harvest was below the average by about  $9\frac{1}{2}$  cwt. per acre. On the other hand, there was abundant rain during the first half of April. By earlier sowing and the use of an earlier variety it would have been possible to bring the earing stage to April 25-30 so as to make the critical moisture period coincide with a more favourable meteorological moment. For this, however, it would be necessary to know at the end of October what the weather could be in spring. It is not possible to make a good weather forecast for more than 24 hours, or, at a maximum, 48; *the crops cannot, therefore, be adapted to the weather.* If, however, it is impossible to foretell in autumn what will be the atmospheric variations at Bologna and Sciacca (Sicily) during the second half of April, there is no doubt that drought is much more frequent and likely to occur during this period at Sciacca than at Bologna.

*If the crops cannot be adapted to the weather, it is possible to adapt them to the climate, which represents the average weather and is expressed by a series of percentages of probability: — probability of frost, drought, storms, clouds, etc.*

The author applies the term "dry decade" to a period of 10 days where the total rainfall does not exceed 5 mm. By calculating for a certain number of districts over a long period (a minimum of 20 years) the number of times a certain decade has been dry, and comparing these figures to 100, the probability of drought for this decade will be obtained. Assuming that, at the station A, the 2nd. decade of July has been dry 15 times in 20 years, the probability of drought during this period at A will be 75 %.

This percentage is marked on a map at the points corresponding to the different stations. All the points where the probability of drought is from 70 to 100 % form one zone, in which drought is certain; those where this probability is from 30 to 70 % form a second zone, and those where it is from 0 to 30 % form a third zone where drought is very rare during the

decade under consideration. The zones are marked in different colours. In this way a chart will be obtained for each decade which will enable the distribution of *drought* for a given period to be ascertained at a glance. Similar charts would be made for *frost* ("cold decade"), *clouds*, *storms and mist*.

AGRICULTURAL METEOROLOGY STATIONS. — The critical period of a plant with regard to a meteorological factor may be restricted to one or two decades. Taking as example the Agricultural School of Imola where agricultural observations are made, and the nearest meteorological observatory that of Bologna, about 20 miles away, it may well happen that, during the critical period of moisture for wheat, a shower may fall at Bologna while the drought continues at Imola, or vice versa. A comparison between the phenological and biological data registered at the school and the meteorological data of the observatory may, therefore, lead to erroneous conclusions. It is necessary that the biological and meteorological observations be carried out at the same time and place: — the agricultural meteorology station.

The author considers that an entirely new scheme is unnecessary, more especially as in no case should a new station of agricultural meteorology be built, use being made of those stations and agricultural schools already existing by supplying them with building, technical staff and experimental fields. Each station should have the following instruments: —

- 1) rain-gauge;
- 2) hygroscope;
- 3) maximum and minimum thermometers;
- 4) earth thermometers;
- 5) bore for taking samples of soil at different depths;
- 6) balance, oven, and accessories required for determining the moisture in the samples.

How many stations are necessary? Where environmental conditions are uniform, as in Russia, where similar topographical and climatic conditions prevail over long stretches, the number of stations may be relatively limited. On the contrary, in Italy (as in Greece), with the exception of the valley of the Po, which is fairly uniform, the country varies greatly, even within limited zones, so that it would be necessary to have so many stations that the project becomes almost impossible.

Nevertheless, however variable the geographical distribution of meteorological phenomena harmful to crops may be, the nature and signification of the problems of agricultural meteorology remain the same. Thus, in northern Italy, the district in which wheat suffers from lodging includes all the Po valley, but in central and southern Italy, and in the mountain districts, the action of rain with wind is usually discontinuous, oftendisappearing entirely, without any regularity, in localities sheltered from the wind, according to the topography of the land. The problem, however, is the same in each case: — to create a wheat which is both resistant to lodging and a good producer. If it be assumed that wheat suffers from lodging in 200 stations, if in one of these a wheat with a resistant culm were produced, this type could be introduced with a great

probability of success in all the other 199 stations, wherever they may be situated.

Agricultural research which aimed only at solving well-defined problems connected with analyses of agricultural meteorology could, therefore, be carried out in a relatively small number of stations if it were known at what points and to what extent a certain phenomenon is harmful to a given crop. The agricultural stations, and agricultural schools and institutes forming a network in all the civilised countries of the world could, if adequately fitted up, be used as agricultural meteorology stations. To this list might be added the thermo-hyetometric stations, convents, agents and directors of farms, etc. situated even in most distant lands, who could take observations and help to solve the important problems of agricultural geography and meteorology. Each first class station of agricultural meteorology (agricultural stations and schools), together with the second class stations (thermo-hyetometric) and points of observation (parishes, etc.) dependant on it, form a *fundamental principle of the system (network)*.

TABLES OF GROWTH (*their meaning, construction and use in determining a critical period*). — The data obtained in the stations are collected and classified in tables of growth. Plants are modified during the passage from germination to ripening of the fruit, but the modifications which occur are neither gradual nor continuous. There are relatively short phases during which the plant is greatly modified (disappearance of certain organs and formation of new ones); it then remains anatomically and physiologically stationary for a long period, till another phase takes place. There are, thus, *phases of growth* (flowering, earing, etc.) and *interphasal periods* or *subperiods* between two successive phases. It may be assumed that the structure and requirements of a plant remain constant throughout a sub-period.

This phenomenon may be represented by a discontinuous curve, composed, however, of elements almost parallel to the line of the  $x$  joined by almost parallel segments to the line  $y$ .

The growing period of cereals is divided into sub-periods as follows: —

- 1) from sowing till the seedling appears;
- 2) from this phase till winter interrupts growth;
- 3) from this interruption till growth restarts in spring;
- 4) from the restarting of growth to earing;
- 5) from earing to complete maturity.

For each of these sub-periods there is a special table — table of growth — in which are noted all the meteorological and phenological factors of the plant studied, as, for example: —

Table IV. — Wheat.	Station.....	Year.....
Fourth sub-period — From restarting of growth to earing.		
1) Variety.		
2) Date when growth restarted in the whole field.		
3) Remarks on tillering during the 4th. sub-period		

By tillering is meant the emission of lateral shoots, which usually takes place in autumn, but which may occur in a cold, late spring, as is frequently found in the mountains.

- 4) Lengthening of internodes. . . . .
  - a) day when first observed in a few plants . . . . .
  - b) day when observed for the majority of the plants . . . . .
- 5) Degree to which temperature, humidity, sun, etc., favour or inhibit the growth of the internodes. — . . . . .
- 6) Date of appearance of first ears . . . . .
- 7) Date of earing of the majority of plants . . . . .
- 8) Development of this phase, whether uniform, rapid or slow . . . . .
- 9) Influence of weather on earing. . . . .
- 10) Duration of 4th. sub-period . . . . .
- 11) Note, during the 4th. period:
  - 1) frosts . . . . .
  - 2) storms . . . . .
  - 3) drought. . . . .
  - 4) clouds . . . . .
  - 5) other meteorological phenomena . . . . .
- Note, in each case:
  - a) date and duration. . . . .
  - b) intensity. . . . .
  - c) damage caused to plants . . . . .
  - d) effect on soil (washing, baking, cracking, etc.) . . . . .
- 12) Degree to which the variety grown proved resistant to adverse meteorological factors (drought, lodging, excessive moisture, etc.) . . . . .
- 13) Injury by disease or insect attacks . . . . .
- 14) Degree to which atmospheric variations favoured the appearance of disease or insects . . . . .
- 15) Cultivation of plot during the 4th, sub-period . . . . .

TABLE I. — *Moisture of soil, height of plants and depth of roots.*

Month and day	Moisture of soil (%)			Date of last rain before taking of sample	Depth of roots, inches	Height of plant, inches
	Active layer	Virgin layer	Subsoil			

*Soil moisture.* — The periodical determination of the soil moisture at different depths is of great interest, increasing with the frequency with which the determinations are made. However, in view of the amount of work required it is best to allow the directors of the various first class agricultural meteorology stations to decide for themselves the frequency with which such determinations shall be made.

Besides the periodical determinations the soil moisture must be taken at two moments — 15 days before earing, and at the beginning of this phase.

*Height of plants.* — The height of the plants before earing is measured from the level of the ground to the base of the highest leaf, and after earing from the level of the ground to the tip of the ear. The day the one method, is replaced by the other account must be taken of the two factors bearing on the height of the plant calculated from the ground level to the base of

the highest leaf on one hand, to the tip of the ear on the other, as, for example,  $\frac{72 \text{ (stem)}}{76 \text{ (ear)}}$

The average height of 10 normal plants taken haphazard here and there represents the average height of all the plants.

*Depth of roots.* — A lump of soil, together with all the plants on it, is raised about 6 inches, and the depth measured on the vertical section. This determination is made 3 times: — 1) when growth restarts; 2) 15 days before earing; 3) at the moment of earing.

TABLE II. — *Number of plants and culms; vigour of tillering; average weight of dry mass of plants; number and weight of weeds.*

Month  and 'day	Grasses studied								Weeds		
	Number of plants with						Total number of culms	Weight in grams of dry seedling	Vigour of tillering	Number of samples	Weight in grams in dry condition
	one culm	two culms	three culms	four culms	many culms	Total number of plants					

N. B. — This table must be filled in at the moment when the internodes begin to lengthen.

1) *Vigour of tillering.* — This is calculated by dividing the total number of culms by the number of plants.

2) *Determination of the weight of the plants and weeds.* — In four different parts of the plot the plants are uprooted from about  $\frac{1}{4}$  sq. yard; the weeds are separated from the plant studied; the root system is removed and the green part left to dry; when a constant weight is obtained the value is entered in the table.

TABLE III. — *Number of plants and culms; vigour of tillering; vigour of earing; weight of dried mass of the plants; number and weight of weeds.*

Month  and day	Grasses studied									Weeds		
	Number of plants with					Number of culms			Weight in grams of dried plants	Vigour of tillering	Number of plants	Weight in grams in dry condition
	one culm	two culms	three culms	four culms	many culms	Total number of plants	plants earing	plants not earing				

N. B. — This table must be filled in at the end of the earing stage.

TABLE IV.

Month	Meteorological observatory													
	Air temperature							With wet-bulb thermometer			Percentage of relative humidity			
	7h.	13h.	21h.	Total	Average	Maximum	Minimum	7h.	13h.	24h.	7h.	13h.	21h.	Average

TABLE V. — *Temperature of soil.*

Date	At the surface				In active layer				In virgin layer				In sub-soil			
	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average	7h.	13h.	21h.	Average

TABLE VI.

Date	Rain		Mist				Clouds	Storms	Other meteorological phenomena
	in inches (or mm.)	duration	7h.	13h.	21h.	Average			

The table of growth (composed of the above tables) is reproduced because it contains all the material necessary to a complete study of agricultural meteorology. For each variety there will be a table of growth corresponding to each of the interphasal periods.

**DETERMINATION OF THE CRITICAL PERIOD.** — The yield in fruit is the measure by which the more or less favourable action of meteorological phenomena must be judged. The higher the yield the more favourable was the weather during the growing period in general and the critical periods in particular. If the data concerning wheat at station A from 1901 to 1910 were available the following facts could be deduced: — there is no relation between total precipitation and yield in grain or between yield and total precipitation during the 1st., 2nd. and 3rd. sub-periods. If, however, the data on the yield and total rainfall during the 4th. sub-period are compared, a direct relationship is seen to exist. The critical rain period of wheat is, then, the 4th sub-period.

By limiting in this way the field of research to a relatively narrow scope it is easy to define exactly a critical period. No important phenological action is observed between the restarting of growth and the earing phase. The critical period, then, is the earing phase. At this moment the plant does the greatest amount of work by elaborating the enormous quantity of plastic substances necessary for the formation and development of the caryopses and by consuming a great amount of water. There is an average of about 40 days between the earing and ripening phases. During this time occurs the whole process of growth, the last phases succeeding each other rapidly — flowering, development and ripening of the caryopses.

To assure a good wheat harvest abundant rain is necessary during the decade, or two decades, preceding earing so that the plant may have the moisture necessary for rapid and strong growth. In warm countries, where there is a great probability of drought during the earing period, the critical period just mentioned is very evident and has a marked influence on the harvest. In proportion as the cold northern countries where rain is nearly always plentiful at the requisite time are approached, all relation between precipitation and yield disappears, while other critical periods arise, as, for example, an inverse relation between yield and rain during flowering.

The specific action of all the other meteorological factors could be established in a similar way.

THE MANNER IN WHICH KNOWLEDGE OF THE CRITICAL PERIOD, PHENOLOGICAL MAPS AND WEATHER CHARTS PERMITS AN INCREASE OF YIELD BY ADAPTING THE VARIOUS CEREALS TO THE CLIMATE. — When a scale of the yields has been established (*i. g.* for wheat, cwt of grain per acre), it is possible to distinguish the zones of good, medium and bad harvests. Thus, the zone of good harvests includes districts where the average yield of wheat exceeds 13 cwt. per acre, that of poor harvests where the yield is less than  $9\frac{1}{2}$  cwt. per acre; the medium zones includes the districts with yields between  $9\frac{1}{2}$  and 13 cwt.

The aim of agricultural meteorology is to increase the zone of good harvests at the expense of the other two. Statistics are but a statement of facts; the expression "bad harvest" merely means that the meteorological factors during the period of growth in general and the critical periods in particular are unfavourable to the growth of the plant, but does not show which was the unfavourable factor or the means to remedy it. To do this agricultural meteorological analysis is necessary. Many meteorological phenomena may damage wheat, for example, in Italy. In the south there may be: —

1) warm, dry winds (sirocco, "favonio") which, during the ripening of the ear (5th. sub-period) cause scorching, followed by hastened ripening, drying up of the grain, and, while the plants are still strong, the caryopses lose food material or do not form at all. This is particularly serious in light soils or where there is only a small layer capable of being cultivated and, in some years, within a few days, the yield is reduced by 25, 30, or even 50 %.

2) lack of rain during the 10 or 20 days preceding earing;

3) prolonged drought during the period following sowing.

Rust is little to be feared because excessive humidity in spring occurs rarely and only over very limited areas. Lodging is unknown because in the islands, most of Calabria and in Basilicata hard and semi-hard grain with short, strong straw is grown.

In central and northern Italy, on the contrary, the following facts must be noted with regard to climate: —

1) in the valley of the Po, particularly in the lowest part, wheat almost invariably suffers from excessive moisture which causes rust with a resultant serious decrease of yield;

2) lodging caused by wind and heavy rain at the time of the formation and development of the caryopses may lower the yield by 20 to 25 %;

3) considerable damage by late spring frosts.

Such is the knowledge, relatively general, at the present day, when the network of agricultural meteorological stations is to begin its work, aiming at *a*) the determination of the critical period of wheat with respect to the meteorological factors as discussed above, *b*) the preparation of phenological maps, and *c*) weather charts.

Once the critical period is known the comparison of the phenological maps and weather charts allows the suitability of a plant to local climatic conditions to be easily determined. If, for example, at A, wheat ears on May 10 on an average, and if, during the last decade of April and the first decade of May, the probability of drought is 75 and 90 % respectively, this will show why the average yields in this district are relatively low. Once the reason of the poorness of the yield is established it may be remedied in three ways:

1) Change the time of the critical period phase and make it coincide with a more favourable meteorological moment.

*E. g.* the *f* variety of wheat at the station A ears on an average (see phenological map of earing of wheat) on May 12, and the probability of drought during the third decade of April and the first decade of May is 90 and 95 % respectively (see weather charts for drought for the 3rd. decade of April and the 1st. decade of May). This accounts for a low yield. In the first and second decade of April, on the contrary, the probability of drought at A drops to 10 and 15 % respectively. By earlier sowing or by using an earlier type of *f'* wheat, so that earing takes place between April 20 and 25, this drawback could be remedied in part at least.

2) Artificial modification, during the critical period, of meteorological factors, *e. g.* control of frost by smoke, of drought by irrigation, etc. Brilliant results have been obtained with fruit in California by forecasting cold by 24 to 48 hours, thus allowing growers to decrease or even nullify injurious effects by burning heavy oils or other substances which surround the tree with thick, protective smoke.

3) The introduction or production of types of increasing resistance to drought, frost, rust, lodging, etc.

Modern experimental research in biology in various countries has clearly shown that, by hybridisation and subsequent selection, it is possible to unite in one variety the good characters existing in



two distinct varieties and to eliminate undesirable characters. In each particular case the breeder must aim at uniting high yield with resistance to the harmful meteorological character most frequent in the district. Thus, at Svalöf (Sweden), M. NILSSON has obtained types of wheat resistant to cold, and at the same time, excellent yielders by crossing the most productive varieties slightly resistant to cold (English Square-head) with native Swedish wheat very resistant to low temperatures.

This acclimatation of non-native types and creation of new types by crossing and selection would be the most important work of agricultural meteorological stations of the 1st. class. In the choice of these, therefore, use would be made of agronomic and agricultural Institutes already existing and not of the meteorological Institutes which may cooperate with them but cannot form centres for new research.

The following example shows that agricultural meteorological study is not only necessary where soil is cultivated for the first time, but that it may give excellent results in districts where intensive culture has been carried out for a long time by determining a better adaptation of crops to the climate of different districts. In the province of Bologna (northern Italy) each farm may be said to grow three varieties of wheat — Rieti, Gentil rosso and Hybride inversable de Vilmorin, distinguished by the following characters :

1) RIETI : resistant to rust but lodges easily ; in favourable years, *i. e.* when it does not lodge as a result of storms, it yields about 17  $\frac{1}{2}$  cwt. per acre ;

2) GENTIL ROSSO : very subject to rust and lodging ; in favourable years, without excessive humidity and destructive storms, it may yield over 19 cwt. per acre ;

3) HYBRIDE INVERSABLE DE VILMORIN : subject to rust but resistant to lodging ; when the humidity is not excessive it may yield 16  $\frac{3}{4}$  cwt. per acre.

Gentil rosso and Hybride inversable are of recent introduction, and other varieties, now under observation in various agricultural institutes, will finally be added to the pre-existing varieties, causing a mixture of wheat which is not always desirable. A single variety best suited to the climate had not been adopted because, it is argued, there is no such variety and none which suffers from the same two causes at the same time, therefore, if in any year one variety fails, there is always one which succeeds, thus compensating for the loss. This is false reasoning. Gentil rosso, when it does not lodge, produces up to 19 cwt. per acre, Hybride inversable only 16  $\frac{3}{4}$ , *i. e.* 2  $\frac{1}{4}$  less ; but the first lodges easily, whereas the second does not. Lodging causes a loss of nearly 4 cwt. per acre, thus reducing the yield from 19 to 15 cwt. The probability of heavy rainfall and wind during the 5th. sub-period in the province of Bologna is, moreover, 80 %. In a period of 5 years there would be : — GENTIL ROSSO  $19 + (15 \times 4) = 79$  cwt ; HYBRIDE INVERSABLE DE VILMORIN  $16 \frac{3}{4} \times 5 = 83 \frac{3}{4}$ . Thus, in the province of Bologna, where the probability of lodging is 80 %, the Vilmorin hybrid is preferable to Gentil rosso.

When, on the contrary, the probability of storms in the 5th. sub-period falls to 20%, GENTIL ROSSO should be preferred: — HYBRIDE DE VIL-MORIN  $16 \frac{3}{4} \times 5 = 83 \frac{3}{4}$ ; GENTIL ROSSO  $(19 \times 4) + 15 = 89$  cwt.

*Agricultural meteorology is, therefore, indispensable if an exact idea of the real productivity of a species in a given district is to be determined.*

The mere fact that a given variety of wheat is grown by preference in a given district is no proof that it is the best, suited to this district. New types are often on the market which may completely supersede the native types, to be superseded later in their turn by other new types. In all such cases it is the character "productivity" which guides the farmer in his choice of seed; but productivity is influenced to a marked degree by climatic conditions, and consequently, varies from one district to another, so that the adoption of new types should be preceded by a careful study of agricultural meteorology.

Agricultural meteorology thus gives a twofold result: —

1) it allows a better distribution of the different varieties of a cultivated species; *i. e.* it shows the districts best suited to each variety from the point of view of local climatic conditions;

2) it guides the selector in his research aiming at uniting to the best advantage in a single type, productivity and resistance to the most destructive meteorological phenomena of the different districts.

The work of adapting crops to climate is difficult, but it cannot fail to lead, in part at least, to positive results, and considering the size and complexity of the problem, these results, even though they be but small, represent large figures.

Unfavourable conditions in Italy diminish the grain harvest, on an average, by over 3 cwt. per acre, and though only  $\frac{1}{2}$  cwt. per acre were gained, the profit would be 9 432 980 cwt. representing a considerable value.

What has been said for wheat applies equally to all other cultivated plants; what has been said for Italy applies to all the countries of the world. On the other hand, it is seen that the network of agricultural meteorology stations is already outlined by the many agricultural schools and institutes and the thermo-hyetic stations possessing the premises, instruments, experiment fields and technical staff. All that is required is to collect, co-ordinate and develop all this latent or dispersed activity, so that the cost of the formation and upkeep of the new service shall be limited.

257 — **The Relation of Winter Temperature to the Distribution of Winter and Spring Grain in the United States: Why Cereals Winterkill.** — SALMON, S. C., I. *Journal of the American Society of Agronomy*, Vol. IX, No. 8, pp. 353-380; II. *Ibid.*, Vol. IX, No. 1, pp. 21-24. Washington, 1917.

I. — In northern districts winter cereals usually give a higher yield than spring cereals, but they are much less widely distributed because they are naturally excluded from zones where the climate is too severe to allow the young plants to survive the winter. The injurious action of the winter may have four effects: —

1) HEAVING. — This is due to expansion and contraction of the soil by alternate freezing and thawing; the roots are broken and exposed to

the air. Shallow sown plants suffer least, as the whole plant will then be lifted without breakage of the underground parts. Heaving is most common in the eastern States, especially in wet, badly drained plains.

2) **SMOTHERING.** — Alternate freezing and thawing sometimes turn the snow into an ice sheet through which the air cannot pass, thus suffocating the plants by lack of air and accumulation of carbonic acid.

3) **PHYSIOLOGICAL DROUGHT.** — This occurs when the soil is frozen and the plant can no longer obtain moisture from it. All the anatomical characters which tend to limit transpiration should, therefore, be in correlation with resistance to cold. Turkey and Kharkov wheat, winter rye and winter Turf oats, known for their resistance to cold have marked xerophytic structures — narrow leaves and prostrate habit of growth, which partially protect the plant from the action of wind (KOLKUNOW, SINZ, etc.). The author and his collaborators, in a study on several varieties of winter wheat, rye, barley and oats, found no definite relation between resistance to cold, cell structure, epidermal covering and ability to control transpiration. Recent studies have, however, shown that a reduction of the leaf area in relation to the length of the root as expressed by the ratio of root length to leaf area does influence the resistance of young plants to cold. In Turkey wheat this ratio is 25 % greater than in Fultz wheat, a less hardy variety, and 40 % greater than in common oats and barley. Physiological drought may be considered, if not as the only cause of winterkilling, at least as the most important.

4) **DIRECT EFFECT OF LOW TEMPERATURE.** — This acts in many ways: —

a) *Mechanical action.* — Injury to the tissues caused by the formation of ice.

b) *Desiccation of the protoplasm.* — Low temperatures cause withdrawal of water to the intercellular spaces, where it freezes; when later, the ice thaws rapidly the moisture can no longer be absorbed. At  $-13^{\circ}\text{C}$ . the loss of water is 63.7 %; at  $-15.2^{\circ}\text{C}$ ., 79.2 %.

c) *Coagulation of the proteids.* — In plants resistant to cold this only takes place at very low temperatures; thus for pine needles a temperature of  $-40^{\circ}\text{C}$  is required, in winter rye  $-15^{\circ}$  and in begonia, which is very sensitive to cold,  $-3^{\circ}\text{C}$ . This coagulation is accompanied by denaturing of the proteids, caused, perhaps, by increased acidity of the sap, so that they can no longer be reabsorbed. This theory is held by GORKE but contradicted by CHANDLER's experiments, which showed zinc sulphate, one of the salts which readily coagulate proteids, to increase rather than to diminish resistance to cold.

LIDFORSS, in his studies on *Holosteum*, *Cerastium*, *Lamium*, *Veronica*, *Senecio*, *Viola*, *Fumaria*, etc., observed that, on the approach of winter, the starch in the tissues of these plants changed to sugar, which, by changing the concentration of the sap, reduces the freezing point. These phenomena of the protective action of various substances due to the lowering of the freezing point have formed the subject of much research (MAXIMOV, etc.), which confirms the theory of LIDFORSS.

II. — The specific action of low winter temperatures on winter ce-

reals is clearly shown by a study comparing the northern boundary of different varieties with the isotherms of the minimum temperatures during January and February.

**WINTER WHEAT.** — Its northern limit corresponds approximately to the isotherm of  $10^{\circ}\text{F}$  ( $-12.2^{\circ}\text{C}$ ). Cold resistant varieties may exceed this limit if the seed is well protected by a covering of snow.

**WINTER BARLEY.** — Its northern limit coincides with the isotherm of  $20^{\circ}\text{F}$ . ( $-6.6^{\circ}\text{C}$ ). It is successfully grown to the west of the Rocky Mountains and to the south of the Ohio and Platte rivers.

**WINTER OATS.** — Its northern limit corresponds to the isotherm of  $30^{\circ}\text{F}$  ( $-1.1^{\circ}\text{C}$ ). They may be grown, in the north, as far as Central Tennessee and Arkansas and southern Maryland and Oklahoma.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

258 — **Effect of Decomposing Organic Matter on the Solubility of certain Inorganic Constituents of the Soil.** — JENSEN, C. A. (Assistant in Plant Malnutrition, Office of Biophysical Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. IX, No. 8, pp. 253-268. Washington, May 21, 1917.

The experiments described were undertaken to determine if the beneficial action of decomposing organic substances (humus) is due to the solution of the inorganic substances of the soil, and, if so, to what extent. Water extracts of green barley hay, sweet clover and alfalfa were prepared by saturating 70 gm. of each of these substances in a flask with distilled water, and allowing them to ferment for 14 days. After this period the substances were thoroughly shaken with 1500 cc. of distilled water, and filtered, first through muslin, then through a Chamberland filter. The insoluble residue was again treated in the same manner and other extracts obtained from it. The extracts thus obtained were added to soils in the proportion of 500 cc. of solvent to 250 gm. of soil. The soils used were clay loam and sandy loam,

It was found, in the first place, that by extracting soils with these solutions, two to five times as much calcium was removed as was added in the extracts. In most cases even more magnesium was removed than was added, the increase varying from a small fraction to 80 %. Iron and phosphoric acid were removed in smaller quantities than they were added in the extracts, but the iron dissolved exceeded that dissolved by water by 1.7 to 5.4 times. The solvent action of the different extracts was about the same whether they were prepared from leguminous or non-leguminous plants.

Extracts obtained in a similar way from cow manure removed less calcium from the soil than did vegetable extracts, but their action was the same for the other mineral constituents.

Both the organic and inorganic salts of the aqueous extracts seem to contribute to the solution of the mineral substances of the soil.

Artificial green manures (barley hay, sweet clover, bean straw, alfalfa, etc.) kept moist till thoroughly decomposed, and gave extracts which removed a greater quantity of calcium than was added; they also removed amounts of magnesium, phosphoric acid and iron in excess of those dissolved by water alone. The green manure extracts gave no alkaline

reaction to phenolphthalein and no acid reaction to methyl orange. When the soil was mixed with 3 % green manure and stable manure and left till partially decomposed, the solubility of the calcium and phosphoric acid increased from 30 to 100 %.

To study the action of the organic constituents of the extracts tested, green manure and sugar were hydrolysed with strong acid, washed till free from acid, then extracted with ammonia. When the ammonia was eliminated these extracts represented artificial humus solutions free from calcium, magnesium, iron and phosphoric acid. These extracts, when added to soil, increased the solubility of the calcium as compared with its solubility in water by amounts varying from a few parts to 240 parts per million of soil. They also increased to a lesser extent the solubility of magnesium, phosphoric acid and iron.

In short, in the soils tested, the solubility of calcium, magnesium, iron and phosphoric acid is appreciably increased by the addition of green manure, stable manure or their extracts. This increase in solubility is due, partly to the action of the inorganic salts contained in these substances, and partly to the solvent action of the organic compounds formed during decomposition. The fact that a deficiency in soluble iron causes certain types of chlorosis suggests that the beneficial effect of the addition of organic matter to citrus soils depends partly on its solvent action on iron and other soil compounds, though this has not yet been definitely proved.

259 - **The Proof of Microbial Agency in the Chemical Transformations of Soil.** — CONN, H. J. (New York Agricultural Experiment Station), in *Science*, Vol. XLVI, No. 1185, pp. 252-255. Lancaster, Pa., September 14, 1917.

Care must be taken to avoid inexact statements and ill-founded conclusions as to the part microorganisms play in the chemical changes occurring in soil. In soil microbiology there are statements and deductions similar to those found regarding pathology till light was thrown on it by the fundamental postulates laid down by KOCH for the study of pathogenic bacteria.

Extending these postulates, by analogy, to bacterial activity in soil, the author lays down the following principles for research in soil microbiology :

- a) The organism to which action is attributed must be shown to be present in the soil in an active form when the chemical change studied is taking place ;
- b) this organism must be present in larger number, under such conditions, than in the same soil in which the chemical change is not occurring ;
- c) it must be isolated and studied in pure culture ;
- d) the same chemical change must be produced by the organism in experimentally inoculated soil, the test being made, if possible, in unsterilised soil.

These facts can be shown by the cultural methods used up to the present. It must, however, be remembered that they may lead to errors because naturally inactive organisms may be present which become active under cultural conditions, or the opposite may occur. Cultural methods must, therefore, be checked by others; the microscope may be useful in this respect, but it may prove necessary to devise entirely new methods.

## 260 - The Decomposition of Soil Protein Substances Through the Action of Bacteria.

— ROBINSON, R. H. and TARTAR, H. V., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 135-144. Baltimore, May, 1917.

The experiments described were carried out at the Chemical Laboratory of the Oregon Agricultural Experiment Station, Corvallis. The function of bacteria in the production of ammonia from the protein substances in soil has long been known. How these proteins are acted upon, whether it be a hydrolytic process brought about by enzymatic action, whether it be an oxidative one, or a more complex chemical reaction is still unsolved. This led the author to undertake a series of experiments to ascertain, by controlling the influencing factors as much as possible: — 1) the chemical changes proteins undergo when acted upon by bacteria; 2) the cause of partial ammonification of protein substances; 3) the nature of the reactions in general.

The proteins used were blood fibrin, egg albumin and peptone; the bacteria: *Bacillus subtilis*, *B. mycoides* and *B. vulgaris*. The results obtained show that: —

1) All the nitrogen forms are more or less changed by the action of the bacteria and the end-product ammonia is formed. In no case was one form of nitrogen completely destroyed.

2) The rapidity of action varies greatly with different protein substances; casein showed no further change after a few days, whereas gliadin continued to ammonify after 30 days.

3) One organism does not act alike upon different proteins. The relative proteolytic activities of the organisms used depend on the proteins acted upon.

4) The monoamino-acid nitrogen and diamino-acid nitrogen of the protein are the chief sources of the ammonia formed by bacterial action.

5) The similarity of chemical change between the action of acid hydrolysis and that of bacteria indicates that the latter is largely hydrolysis to the point of formation of various amino-acids.

6) No toxic substance that would inhibit complete ammonification of a protein is formed.

PERMANENT  
IMPROVEMENTS:  
DRAINAGE AND  
IRRIGATION

261 - Irrigation of Orchards in U. S. A. — FORTIER, SAMUEL, in *U. S. Department of Agriculture, Farmers' Bulletin* No. 582, pp. 40, 30 figs., illustrations. Washington, D. C., October, 1917.

This bulletin is a revised edition of that on the irrigation of orchards in the west of the United States, published in 1910.

In the arid and semi-arid districts of the United States the irrigation methods vary with the water supply, climate, soil and situation of the land. The cost of installing and maintaining a system varied greatly. The value of water for irrigation has greatly increased of recent years, and in many districts there is a scarcity of water at certain times. For these reasons many orchard-owners have installed pumps to raise underground water. In 1914 there were in California alone 24 600 plants for raising water for orchard irrigation purposes. In other parts of the West reservoirs are being built

to supplement the insufficient flow in late summer. The canals, previously simply open ditches in earth, have been improved and lined with concrete, and, in many cases, replaced by underground pipes to prevent loss of water. The water is often supplied by companies, who have also greatly improved the distribution of their water.

The trees are planted in lines, squares or hexagons. The most common method of irrigation is by furrows between the rows of fruit-trees. These furrows vary in depth, length and distance apart according to the soil, surface, quantity of water to be used, etc. The head ditches and those for distributing the water in the furrows may be built in various ways, some of them very expensive and only justifiable for large orchards. The bulletin describes the most common types of head flumes, which may be of wood, cement or concrete. The number of furrows between the rows of trees varies with the space between the rows, the age of the trees, the depth of the furrow and the character of the soil. Deep ditches are usually preferred, the most common depth being 8 inches. The grade of the furrows varies; in ordinary soils it does not exceed 3 to 4 inches per 100 feet. The machine generally used for tracing furrows in citrus orchards consists of a sulky frame to which are attached two or three double moldboard ploughs; a 12 to 14 inch corn lister is also used for deeper furrows. The length of the ditches varies from 300 to 600 feet. The time required to irrigate depends on the quantity of water used, the length of the furrow and the nature of the soil.

The orchards are also sometimes irrigated by the basin method by forming, midway between the rows of trees, ridges at right angles to each other. By this method the land is divided into squares with a tree in the centre of each; more rarely each square contains four or more trees. This method has recently been renewed in California because, while thoroughly moistening the soil, it allows the growing of alfalfa and other leguminous plants, to the great advantage of the orchard.

Many orchard owners base the interval between two irrigations on an examination of the vegetation; they renew the stream when the trees show visible signs of suffering, *i. e.* when their leaves begin to change colour or curl. This method is not practical and it is the moisture content of the soil which should be considered. In the state of Washington there are three or four waterings at intervals of 20 to 30 days, the first being given in April or early in May. In Idaho there are three irrigations, beginning about June 15. In Montana the orchards are irrigated towards July 15, August 10 and August 20. In southern California the citrus trees are watered six or seven times during the summer at regular intervals.

The bulletin also deals with loss by evaporation and percolation and with drainage which, under certain conditions is frequently necessary.

MANURES  
AND MANURING

- 263 - **The Influence of Fineness of Division of Pulverised Limestone on Crop Yield as well as the Chemical and Bacteriological Factors in Soil Fertility.**—KOPELOFF, N., in *Soil Science*, Vol. IV, No. 1, pp. 19-67 + 2 figs., bibliography of 124 publications. Baltimore, July, 1917.

After discussing in detail the work published on the liming of soils the author gives the results of his experiments made on various soils with pulverised limestone passed through sieves of 20-40, 60-80, 100-200 and more than 200 mesh. These experiments were compared with control plots with burnt lime.

An increase in the fineness of the lime gave a proportionate increase in the yield and nitrogen content of crimson clover. The finer the lime the more rapid was the neutralisation of the acidity of the soil and the greater the bacterial processes of ammonification, nitrification and nitrogen fixation. In the case of barley, buckwheat and rape, fine limestone without nitrogen gave yields equal to those obtained with coarse limestone with an application of 660 lbs. of ammonium sulphate per acre. Limestone passed through a 200 mesh sieve may be considered as efficacious as burnt lime. An increase in the fineness of the limestone decreases the lime-requirement of the soil, but the drainage waters show a smaller loss of ammonia and nitric nitrogen, but an increased loss of calcium.

- 264 - **Fermentation of Manure Treated with Sulphur and Sulphates: Changes in Nitrogen and Phosphorus Content.**—AMES, J. W. and RICHMOND, T. E. (Ohio Agricultural Experiment Station), in *Soil Science*, Vol. IV, No. 1, pp. 79-89, bibliography of 21 publications. Baltimore, July, 1917.

It is known that the addition of acid phosphate to manure helps to preserve the nitrogen, and the treatment of manure with gypsum is also a common practice. Recently, however, LIPMAN and his co-workers have called attention to the beneficial effect of treating compost heaps with sulphur and the by-products of mineral phosphates ("floats") which supply available phosphorus (1). To study the influence of sulphur and other materials on the fertilising value of manure as measured by its composition and effects on crops, the authors carried out experiments with solid horse manure and cow's urine treated and untreated with sulphur, calcium sulphate and acid phosphate. The manure was left to ferment in large containers and applied to small plots. The nitrogen, phosphorus, sulphur and dry matter in the manure were then determined.

After 250 days' fermentation the loss of dry matter in horse manure mixed with a litter of fine cut straw was:—32.5 % when untreated, 21.8 % when treated with 342 grams of acid phosphate or 407 grams of calcium sulphate per 30 lbs. manure, and 18.2 % when treated with 90 grams of flowers of sulphur per 30 lbs. of manure. Manure treated with acid sulphate, calcium sulphate and sulphur only lost about 3.5 % of its total

(1) LIPMAN, J. G., McLEAN, H. C. and LINT, H. C., The Oxidation of Sulphur in Soils as a Means of Increasing the Availability of Mineral Phosphates. *Soil Science*, Vol. I, No. 6, pp. 533-539, 1916. ID. Sulphur Oxidation in Soils and its Effect on the Availability of Mineral Phosphates. *Ibid*, Vol. II, No. 6, pp. 499-538. (Ed.)



nitrogen, whereas the loss in untreated manure was 10.5 %. Both the water-soluble and the citrate-insoluble phosphorus was decreased in every case. During fermentation manure treated with sulphur increased in acidity, whereas the untreated sample became alkaline.

Sulphur, calcium sulphate and acid phosphate were all very effective in preventing loss of nitrogen from urine. In 5 weeks the untreated urine lost 80 % of its nitrogen, that treated with 7 grams of sulphur per 500 cc. lost 10 %, that treated with 27 grams of calcium sulphate per 500 cc. lost 9.72 % and that treated with 27 grams of acid phosphate per 500 cc. lost 5.1 %. Sulphur also prevented the formation of ammonium salts, whereas with calcium sulphate 68 % of the total nitrogen was transformed into ammonium sulphate. In urine treated with acid phosphate and kept in an open jar for 27 days no ammoniacal nitrogen was formed, but after being kept 3 months in a closed jar it turned alkaline and evolved ammonia.

**265 - Garbage Tankage, its Composition ; The Availability of its Nitrogen and its Use as a Fertiliser.** — SCHROEDER, P. J. (Bureau of Soils, U. S. Department of Agriculture), in *The Journal of Industrial and Engineering Chemistry*, Vol. IX, No. 5, pp. 513-518. Easton, Pa., May, 1917.

In about half of the towns of the United States garbage is treated by 29 companies and municipalities for the extraction of fat ; the residue, called " tankage " is considered as a low grade fertiliser. In 1914, 1 200 000 tons of garbage were dealt with yielding, besides the fat, 173 000 tons or 15 % of tankage, valued at \$ 1 157 000 at pre-war prices, but now worth almost twice as much. If the garbage of all towns with a population of more than 30 000 were so dealt with, the production of degreased garbage would exceed 345 000 tons and be worth over 4 million dollars.

In some cases the bits of glass, tin, etc. are first eliminated from the garbage ; it is then treated by one of the following methods : —

- 1) Cooking under pressure with steam (tanking) ; elimination, as complete as possible by pressing, of water and fats liberated, from which the oil is separated by settling and skimming ; extraction with gasoline of the grease remaining in the solid residue after it has been dried.

- 2) Crushing to render the particles uniform in size ; drying, followed by extraction with gasoline ; grinding of the solids for tankage.

- 3) Heating with boiling gasoline to evaporate the water and extract the fat.

In some plants where the first process is used the dried tankage is not extracted with gasoline for the recovery of the fat ; in others the aqueous solution is evaporated to a sticky consistency and mixed with the degreased tankage which is then re-dried.

In appearance garbage tankage is a coarse, brown powder, either granular or finely fibrous ; it generally contains bits of bone, crockery or glass in proportions varying with the degree of care with which the sorting has been carried out. The appended table gives the average chemical composition of 75 samples of raw garbage and 20 samples of tankage from various plants ; the fat was not extracted from four of these last samples.

*Average composition of treated and untreated garbage.*

	Moisture	Ash	Ether extract	Potash	Nitrogen	Phosphoric acid	Combustible matter
Raw garbage . .	73.78%	3.60%	5.32%	0.27%	0.70%	0.43%	22.63%
Tankage . .	3.67*	29.15*	4.92 <sup>1</sup>	0.80*	2.78*	3.56*	

\* Percentages calculated on moisture free basis.

Attempts have recently been made to use tankage as cattle food by employing flotation methods to remove the hard matter. It is, however, largely used as fertiliser material, to which, by its composition, it is well suited. It has only been used successfully as a low grade fertiliser and its high organic content makes it of increased value for soils poor in humus.

Tankage is sold at a relatively low price because of the general opinion that its nitrogen is of a limited fertilising value. The author's investigations show this opinion to be erroneous; estimations by the alkaline permanganate method showed 40 % and more of assimilable nitrogen as compared to 57 % in cottonseed meal, and nitrification tests gave equally good results. About  $\frac{1}{4}$  of the total nitrogen of garbage is soluble in water, and this proportion may be increased considerably by treatment with sulphuric acid.

Seeing that other high-grade organic nitrogen fertilisers, such as cottonseed meal and slaughter-house residues, are being used more and more as food for stock, and that garbage tankage contains a large amount of nitrogen, garbage tankage should be more generally used as a fertiliser, thus permitting not only of a more complete utilisation of the garbage, but also of increased municipal profits.

266 - **Effect of Three Annual Applications of Boron on Wheat** (1). — COOK, F. C., and WILSON, J. B. (Bureau of Chemistry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No. 12, pp. 591-597, bibliography of 6 publications. Washington, September 17, 1917.

In the experiments described, horse manure, containing sufficient borax to kill fly larvae, was used as fertiliser on plots on which wheat was grown during three successive years to determine whether boron used as a larvicide is detrimental to wheat. At the same time another plot was treated with manure containing colemanite (a borate of lime). There was also one plot used as manured control and another used as unmanured control. The borax was applied at the rate of 154 lbs. of boric acid per acre (a quantity sufficient to kill the larvae) during the first year, and at the rate of 38.5 lbs. per acre during the two subsequent years. The colemanite, a less efficient larvicide, was applied at the rate of 50.75 lbs. of boric acid per acre each year.

In the case of large applications of borax during the first year a considerable yellowing of the young wheat plants was noticed and, as compared with

(1) See R. Aug., 1916, No. 854. (Ed.)

the manured control plot, a reduction of 10 % in the yield during the first two years, whereas the effect of colemanite was hardly noticeable. In the last year all the yields were low except that of the borax-treated plot, which was relatively high.

The wheat absorbed only minute amounts of boron (slightly more, however, from the borax), and the distribution of the boron was relatively uniform in the straw and the grain.

The presence of soluble boron was found in the soil after a heavy application of borax, but not in the other cases. The boron apparently is gradually combined in an insoluble compound and so distributed that the upper 6 inches of soil show little total boron after three yearly additions of borax. There is no evidence of any cumulative action of boron in the soil. It is apparently the soluble boron, not the total boron, in the soil which injures wheat plants.

267 - Occurrence of Manganese in Insect Flower Stems. — MC. DONNELL, C. C. and ROARK, R. C. (Insecticide and Fungicide Laboratory, Miscellaneous Division, Bureau of Chemistry, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. XI, No. 3, pp. 77-82, bibliography of 16 publications. Washington, October 15, 1917.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

To detect the adulteration of pyrethrum insect powder (*Chrysanthemum* [Pyrethrum] *cinerariaefolium* Vis.) UNGER (1) recommended testing it for the presence of manganese, which is absent in pyrethrum stems. This statement has been contradicted by other workers. The authors carried out quantitative determinations of the manganese content of the stems and open and closed flowers of pyrethrum of both Dalmatian and Japanese origin.

The analyses showed the manganese content of both stems and flowers to vary considerably, and the difference between the two parts of the plant to be so small that the determination of the manganese content as a control of the amount of stem in an insect powder would be useless. Moreover, pyrethrum from Japan contains more manganese than that from other countries, owing, presumably to the high manganese content of the volcanic soils of Japan. An increase in the manganese content of pyrethrum is accompanied by a slightly higher nitrogen and phosphoric acid content.

268 - The Proteins of the Peanut, *Arachis hypogaea*: The Distribution of the Basic Nitrogen in the Globulins Arachin and Conarachin. — JOHNS, CARL O. and JONES, D. BRESEE, in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 33-38. Baltimore, May, 1917.

In a recent paper (2) the authors showed that the globulins of the peanut contain a relatively high percentage of basic nitrogen; arachin, the chief protein of the peanut, contains 4.96 %, and conarachin 6.55 %. These values were obtained by the Hausmann method, in which no correction is made for the solubility of the phosphotungstates of the bases, and are, therefore, lower than those obtained by the Van Slyke method, in

(1) UNGER, H., Flores Chrysanthemi, *Pharm. Ztg.* XXXII, 96, 685-686, 1887. — *Id.* *Ibid.*, XXXIII, 23, 166-167; 1888. — (2) See R. Feb, 1917, No. 128. (*Id.*)

which this correction is made. The authors, therefore, analysed these globulins by the Van Slyke method and found both to contain arginine, histidine, lysine and cystine in the following proportions:

*Percentage of Basic Amino-acids in the Globulins of the Peanut.*

	Arachin	Conarachin
Arginine . . . . .	13.51	14.60
Histidine . . . . .	1.88	1.83
Lysine . . . . .	4.98	6.04
Cystine . . . . .	0.85	1.07

The figures for cystine are undoubtedly too low as they represent only the cystine which escaped destruction during the hydrolysis of the proteins with hydrochloric acid.

The two globulins also give a marked reaction to tryptophane. Considering the high proportion of lysine in the proteins of the peanut and peanut meal (which contains about 28 % of protein [ $N \times 6.25$ ] when made from whole nuts, and 45 % when made from shelled nuts), both might be advantageously used to supplement diets deficient in lysine (1). For example, gliadin, the protein of wheat, only contains 1.21 % of lysine; zein, the protein of maize, contains none at all. On the other hand, legumin of the pea and phaseolin of the kidney bean are relatively rich in lysine, containing 4.29 and 4.58 % respectively.

269 - **Sedoheptose, a New Sugar from *Sedum spectabile*.** -- LA FORGE, F. B. and HUDSON, C. S., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 61-77. Baltimore, May, 1917.

The aqueous extract of the leaves and stems of *Sedum spectabile* contains a non-fermentable, reducing sugar. Analyses of its crystalline phenyl and bromo-phenyl osazones show it to be a new heptose which the authors call sedoheptose. By reduction of a solution of the sugar with sodium amalgam, two heptahydroxy alcohols, designated as  $\alpha$  and  $\beta$  sedoheptitol were obtained. In all probability sedoheptose is a ketose, as bromine does not oxidise it and the two above-mentioned alcohols probably result from its reduction.

270 - **Influence of Hydrogen-Ion Concentration of Medium on the Reproduction of *Alfalfa Bacteria*.** -- FRED, E. B. and LOOMIS, N. E. (Department of Bacteriology, University of Wisconsin), in the *Journal of Bacteriology*, Vol. II, No. 6, pp. 629-633, 1 diagram, bibliography of 7 publications. Baltimore-London, November, 1917.

MICHAELIS, CLARK and others have shown the hydrogen-ion concentration of the medium to have a great influence on its reaction and the bacte-

(1) OSBORNE and MENDEL (*Journal of Biological Chemistry*, Vol. XVII, p. 325, 1914) and other workers have shown that lysine is essential to the growth of animals. Nutrition experiments (HOPKINS, F. G., *Journal of the Chemical Society*, Vol. CIX, p. 629, 1916) have shown that the animal organism cannot synthesize lysine which must, therefore, be supplied in the food in sufficient quantity to ensure normal growth.

OSBORNE and JONES (*American Journal of Physiology*, Vol. XXIV, p. 438, 1909) found the following different percentages of lysine in the muscle substance of different animals: -- scallop (*Fecten irradiatus*), 5.77 %; halibut (*Hippoglossus vulgaris*), 7.45 %; chicken, 7.21 %; ox 7.59 %. See also B, Jan., 1915, No. 72. (Ed.).

rial processes. Certain species are very sensitive to slight changes, whereas others develop in a medium having considerable variation in reaction. The author studied the effect of this reaction on the growth of *B. radiculicola* from alfalfa.

As culture medium was used a mannitol solution composed of mannitol 10 gm., magnesium sulphate 0.2 gm., monobasic potassium phosphate 0.2 gm., sodium chloride 0.2 gm., calcium sulphate 0.1 gm., distilled water 1000 cc. This solution was divided into 24 parts of 100 cc. each, and the reaction changed by the addition of N/10 sulphuric acid or sodium hydroxide. The hydrogen-ion concentration was determined immediately after inoculation and again two weeks later. The results, given in tables and diagrams, show that the change in hydrogen-ion concentration is much greater with a given increase in acidity than for a corresponding increase in alkalinity, especially after bacterial growth has continued for two weeks. There is a correlation between "hydrogen-ion concentration" and "growth of *B. radiculicola* of alfalfa". This bacterium is much more sensitive to sulphuric acid in mannitol solution than to gram equivalent amounts of sodium hydroxide. The results confirm those of PRUCHA (*New York Agricultural Experiment Station, Cornell, Memoir 5*, pp. 41-47, 1915), who found that normal hydrochloric acid is much more injurious to the multiplication of *B. radiculicola* of alfalfa than equivalent amounts of normal sodium hydroxide. The apparent resistance of legume bacteria to alkali seems to be due to the slight concentration of hydroxyl-ions in the mannitol solution. The highest count was obtained in a neutral solution; small amounts of alkali had very little effect on the number of bacteria. On the other hand, acid in gram equivalent amounts seriously retarded or inhibited growth. The relation of "growth" to "hydrogen-ion concentration" remained almost the same after two and four weeks.

The curves representing the hydrogen-ion concentration of mannitol solution before and after the growth of *B. radiculicola* show clearly that the concentration changes under the effect of the growth of the bacteria, which, apparently, bring about changes in the reaction of the medium favourable to their reproduction.

## 271 - Influence of Position of Grain in the Cob on the Growth of Maize Seedlings.

—HALSTED, BYRON D. and OWEN, EARLE J., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 6, pp. 267-275. Washington, D. C., September 25, 1917.

The experiments were made at the New Jersey Agricultural Station with 5 ears of each of 20 representative varieties and crosses of maize. The grains from each ear were divided into 10 equal lots, each representing a zone of the ear, ranging from the butt to the tip. The average weight of the grains in each zone of 2 of the 5 ears was determined, and 25 kernels from each lot planted 1 inch deep in a greenhouse bed. In the butt and the tip zones, the smallest perfect kernels were chosen; in the others they were taken at random. The plants were harvested 17 days after sowing.

The emergence of the tips of the seedlings was recorded daily and the averages calculated from it. At harvest time the viability, weight and

length of the seedlings were recorded, and the vigour and variability deduced from them. By averaging the 5 units in each set, a series of tables was obtained showing the relationship of the position upon the cob to the following particular characters under consideration: 1) weight of grain; 2) specific gravity of grain; 3) emergence of seedlings; 4) viability of seeds; 5) weight of seedlings; 6) length of seedlings; 7) variability in length. Table I gives information concerning the average weight of the grain, Table II the order of the 7 characters considered; No. 1 represents the minimum, No. 10, the maximum value of the averages

TABLE I. — *Average weight (in centigrams) of grains of 20 varieties of corn in each of 10 zones from the butt to the tip of the ear.*

Varieties	Zone										Average
	Butt									Tip.	
	1	2	3	4	5	6	7	8	9	10	
Longfellow . . . . .	43	44	43	42	42	40	39	37	35	31	39.6
Hickory King. . . . .	52	55	56	53	53	51	48	46	46	42	51.1
Golden Queen (ripe) . .	16	17	16	16	15	12	13	13	12	10	14.0
Golden Queen (unripe) .	6	6	7	7	7	7	6	5	4	3	5.8
Champion White Pearl .	40	39	38	37	37	35	35	34	33	29	35.7
Reid Yellow Dent . . .	29	29	28	28	27	26	24	22	20	17	25.0
Iowa Silvermine . . . .	32	32	32	31	31	29	28	27	27	24	29.3
Boone County White . .	40	38	38	37	35	34	33	32	31	28	34.6
King 100-Day . . . . .	40	38	36	36	36	36	36	34	33	28	35.6
Early Leaming . . . . .	34	35	35	34	32	32	32	31	31	29	32.5
Brazilian Flour . . . . .	30	31	31	31	31	30	29	28	27	24	29.4
Stowell Evergreen . . .	30	28	27	26	26	25	25	24	23	21	25.5
Black Mexican . . . . .	28	30	29	29	29	28	27	26	23	20	26.9
Country Gentleman . . .	18	15	15	14	14	13	13	14	12	11	13.9
Golden Bantam . . . . .	26	27	27	27	26	26	24	23	21	18	24.5
Crosby Early . . . . .	25	25	24	23	23	22	20	20	18	17	21.7
Golden Queen × Hickory King. . . . .	26	28	29	28	28	27	27	25	23	18	25.9
Squaw × Country Gent- leman . . . . .	25	25	25	24	24	23	23	22	22	18	23.1
Golden Queen × Cham- pion White Pearl . . .	27	27	26	27	26	25	24	22	20	18	24.2
Golden Queen × Brazi- lian Flour. . . . .	24	24	24	23	23	22	21	21	20	18	22.0
Total	591	593	586	575	565	545	530	508	481	424	
Average	29.6	29.7	29.4	28.8	28.3	27.2	26.5	25.4	24.1	21.2	

Thus, for the general average, with the exception of the butt zone, the weight of the grain decreases from the butt to the tip.

TABLE II. — *Order of the averages for the characters studied.*

Character	Zone									
	1	2	3	4	5	6	7	8	9	10
Weight of grain . . . . .	9	10	8	7	6	5	4	3	2	1
Specific gravity . . . . .	4	5	7	8	9	10	6	3	2	1
Emergence . . . . .	1	10	9	8	6	7	5	2	4	3
Viability . . . . .	1	3	4	10	7	9	6	8	5	2
Vigour . . . . .	2	9	8	10	7	6	5	4	3	1
Length . . . . .	2	3	9	10	8	7	6	5	4	1
Variability . . . . .	10	8	3	5	4	2	6	1	7	9

The *specific gravity* ranges from 1.35 in Golden Queen to 1.16 in Brazilian Flour. The sweet corns have a high specific gravity, due to their low starch and high sugar content and the horny texture of their endosperm. The cross between the two above-mentioned varieties has a specific gravity almost exactly intermediate to the two extremes — 1.26; the other two crosses are also near the mother plant. In a general way the specific gravity decreases in both directions rather regularly from the middle of the ear. If 5 groups are made from base to tip, the totals of the ranking figures are 9, 15, 19, 9, 3. This shows that the decrease is much more rapid in the upper than in the lower half of the ear. If only 3 groups are made, namely, the basal three, the middle three, and the 4 upper zones, the averages of the specific gravities are 1.25, 1.26 and 1.24.

As regards *rapidity of germination* (time between sowing and emergence of the tip), the average for all zones is somewhat less than one week (6.44 days). The butt zone emerged the quickest (a little over 6 days), while the zone just above it took 10 hours longer and was the slowest of all the zones. There was a fairly uniform decrease in time for emergence from the 2nd. to the 10th. zone. This is in correlation with the specific weight, *i. e.* the lighter the grain the more rapid is emergence.

The general average of the *viability* of the grain was 91.91 %, although the unripe ears of Golden Queen only gave 67.87 %, Brazilian Flour 76.94 % and Stowell Evergreen a little more. As has been always observed in previous studies sweet maize, as a group, has the lowest viability. The maximum viability is found in the 4th. zone (94.44 %) ; the minimum in the basal zone (87.68 %), which is closely followed by the tip. The five best zones are the central one and the two contiguous to it on either side. Whereas the heaviest grains are in the lower half of the ear, those of greater density and viability are in the middle zones.

The *vigour* is expressed by the live weight of the plant minus the weight of the grain from which it sprung. For the whole ear the averages of the 20 varieties or crosses tested (see Table I) were (in grams): — 2.277, 3.050, 1.082, 0.356, 2.744, 1.339, 2.374, 2.134, 2.105, 1.911, 1.155, 2.447, 1.098, 1.832, 2.326, 2.198, 1.777, 1.898, 2.272, 1.928; the averages for all the varieties and crosses for each of the 10 zones are: — 1.893, 2.125, 2.116,

2.133, 2.094, 2.064, 2.010, 1.966, 1.896, 1.503; the general average for all the varieties and crosses and for all the zones was 1.980. These results show that, as regards vigour, the best grains are those in the lower half of the ear, with the exclusion of those at the butt, which are very weak. The upper zone shows a uniform decrease in vigour from the 6th. zone to the tip.

There is a strong positive correlation between viability and vigour; the most viable seeds are the most vigorous, and the same naturally applies to the length of the seedling.

Variability is evidently correlated with weakness, but to determine to what degree, measurement of more than 2 500 seedlings must be taken. In other words, viability and vigour are negatively correlated with variability. A set of strong plants is more uniform than one of weak seedlings. Variability is greatly influenced by position on the cob; this may be due to size as well as to maturity and nourishment of the grains.

A practical application of these results would consist in germinating a large sample, say 20 grains, from two rows upon opposite sides near the middle of the ear, selecting ears showing practically 100 % viability, and planting only grains from the middle of the ear, rejecting those from the butt zone and the four upper zones. This would be a more rigorous method than that, now in use, of discarding a few of the grains from the butt and tip of the ear.

272 - **Graft Hybrids Observed on Olive and Maple Trees in Italy.** — *L'Italia agricola*, Year LV, No. 1, p. 17 + 1 coloured plate. Placenza, January 15, 1918.

The coloured plate shows a Cannellino olive tree with white fruit which, when grafted on a Caiazzana olive tree with black fruit, produced white and black olives.

A variegated maple is also reported which, when grafted on a green maple, bore a branch having all the characters of the green maple and none of those of the variegated maple (1).

273 - **The Luleå Branch of the Svalöf Station, North Sweden.** — TEDIN, HANS, in *Sveriges Utisdeförenings Tidskrift*, Year XXVII, Pt. 5, pp. 223-232. Malmö, 1917.

Svalöf and Luleå are separated by more than 10 degrees of latitude, and the physiographical conditions of each differ widely (2), especially where the

PLANT  
BREEDING

(1) For other graft hybrids reported in Italy, see *B. Sept.*, 1915, No. 928. (*Ed.*)

(2) The following facts show the differences between the climatic conditions of the south (Svalöf) and the north (Luleå) of Sweden. It is the custom, which, moreover, corresponds fairly well to reality, to call, in these districts, "summer" the period when the average daily temperature is above 10° C, "winter" the period when it is below 0° C, and "autumn" and "spring", the two intermediate periods. Taking this distribution as a basis, in northern Sweden, summer barely lasts two months, till the middle of August, whereas, in southern Sweden, it begins in the middle of May and lasts to the middle of October, *i. e.*, four months in all. The contrast between north and south is still more marked as regards the growth of cultivated plants if the part of the year free from frosts is considered; at Karesuando (Norland) the last spring frost occurs, on an average, on June 15, and the first autumn frost on August 25, so that the frost-free period hardly lasts 72 days; at Stockholm, on the contrary, there are 4 ½ months without any frost and, in the Island of Ven (Öresund), 6 months. (GUINCHARD, J., *Schweden*, Vol. 1, pp. 43-44, Stockholm, 1913).



growth of cultivated plants is concerned. The aim of the selector is to unite in one variety the characters "intrinsic yield" and "resistance to the most unfavourable meteorological phenomena" in a given locality. As the intensity and distribution of the meteorological phenomena at Svalöf and Luleå differ, it follows that varieties selected at Svalöf do not stand the same chance of success when introduced into Norrland. Experiments on this subject gave absolutely negative results and it was, therefore, decided to form a special centre of selection for the north of Sweden — the Luleå branch Station.

**EARLINESS.** — All crops, especially cereals, in proportion as they grow further south, have a shorter period of growth which allows the plant to attain and exceed the ripening stage during the short summer. What degree of earliness is required for the conditions found in Norrland? It was thought possible to solve this question by using in selection varieties from the northern districts, but it was soon seen that the place of origin is no guarantee of success. Thus, for example, among the barleys grown in the Norrland area early and late varieties. As a whole these varieties answer fairly well to the average climatic conditions and annual variations, but, when separated and grown in pure lines, they may give negative results. The variety No. 01243, a six-rowed barley, isolated at Svalöf from material sent from Luleå, when introduced into Norrland, proved too late, ripening about a week after the local types. Nos. 01201 and 01222, six-rowed barleys from Dalarna (central Sweden), on the contrary, proved in Norrland, as early as the northern types. This may be explained by the fact that every variety transported from one district to another shows a tendency to adapt itself to the new conditions by developing the necessary characters. In southern Sweden the earliest forms of a given type tend to decrease their degree of earliness, or to make it disappear altogether, whereas it is very difficult to show very small differences, of two days for example, differences which, in the north, corresponding to the limits of distribution, are of special importance, for two days more or less for a certain variety may make all the difference between ripening and not ripening.

What has been said for earliness also applies to resistance to cold and diseases.

**CHARACTERS OF THE STRAW.** — In Norrland growth is even more rapid and regular than in the southern districts; the barley No. 01201 which, at Svalöf, has a short stem, when sown in the north has a much longer stem, more subject to lodging. This modification, however, is not equal and proportionate for all varieties. Thus, for example, Findelen No. 0161 and No. 0164 (from plants gathered by the author at Findelen, near Zermatt, Switzerland, at an altitude of about 6890 feet) developed culms of equal length both at Svalöf and at Luleå (length of culm about 2 feet). In order to pass a just opinion on the character of the straw, experiments must be carried out in the district to which the variety is destined.

**GRAIN YIELD.** — The earliness, structure of the culm, resistance to cold and disease, which, as has been seen, vary with the environmental conditions, have a marked influence on the yield, so that even the charac-

ter "productivity" changes in different places. Earliness does not suffice to guarantee the strength of the yield at higher latitudes. A striking example of this is given by the very early six-rowed barley, Svalöf No. 01201. During the years 1894-1904 this barley gave an average of 19.11 cwt. per acre, a yield much below that of the Chevalier variety, 23.57 cwt. per acre. This may be explained by excessive earliness (in the south at least) accompanied almost always by decreased productivity. If, however, 19.11 cwt. are not much at Svalöf, they represent a fairly good harvest in Norrland. Attempts have been made to introduce the barley 01210 in Norrland, but, although it was sufficiently early, the results as regards yield of grain were far from encouraging.

The attempts to introduce into the northern districts types selected at Svalöf go back to 1904, the year in which a series of comparative tests with 37 varieties of barley, 21 six-rowed and 16 two-rowed, was carried out at Luleå.

As regards two-rowed barleys, repeated attempts made even with the very early varieties, such as 0116 from Westergötland, 0161 and 0164 from Findelen (Switzerland), were all completely negative. On the other hand, among the numerous varieties of six-rowed barley studied repeatedly, were distinguished 01209, 01222 and 01225, fairly early and good producers, 01209 at least, also having a large, well-formed caryopsis. The variety 01206 from Dalarne deserves special mention. AXEL ULANDER states that in 1908 this variety was still earlier than the very early native barleys of Joukasförvi and Pasala. In spite of these few exceptions the Svalöf varieties have gradually had to give way before those selected at Luleå, natives of the Norrbotten coast, or the province of Tomeå, or else collected from the Luleå district.

274 - **Experiments in Field Technic in Rod Row Tests.**—HAYES, H. K. and ARNY, A. C., in the *Journal of Agricultural Research*, Vol. XI, No. 9, pp. 399-419. Washington, November 26, 1917.

The lack of uniformity in selection methods sometimes makes it difficult to compare the results obtained by different workers. While the very nature of the investigations excludes the use of exact rules, as in chemistry and physics, it is, nevertheless, possible to standardise the methods so as to decrease errors in the estimation of biometrical data.

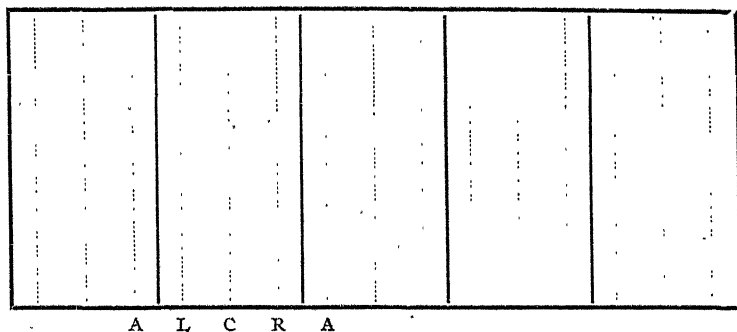
Where cereals are concerned, the size and shape of the plots, the competition between them or their reciprocal action, soil heterogeneity, are all factors which have a considerable influence on the yield, and make it difficult to estimate, because many of the figures are not strictly comparable. The authors have attempted to find a method to reduce these sources of error to a minimum by a series of field experiments with barley, oats and wheat, which aimed at determining:—

1) The effects of competition between adjacent rows of cereals of the same and of different varieties.

2) The planning (length, spacing, number of rows) which will most effectually reduce to a minimum the effects of competition.

3) The number of times an experiment must be repeated to eliminate errors due to heterogeneity of soil.

Each of the experimental plots, adjacent one to the other, contained three 18-foot rows of cereals. The rows were 1 foot apart. In other words there were two border rows, one at the left (L), the other at the right (R), and a centre row (C.). This arrangement is shown for one plot in the following figure, which also includes the adjacent rows (A) of the two plots on either hand.



A. — EFFECT OF THE HEIGHT OF THE ADJACENT LINES ON THE YIELD OF THE BORDER LINES OF ANOTHER VARIETY OF THE SAME SPECIES. — There was one plot for each variety, arranged as described above. At harvest time 1 foot was discarded from each row, reducing the length considered to 16 feet.

To compare the *yield in grain* the following method was adopted; — If the left (L) border row yielded more than the right (R) border row, the result was considered *positive* and the difference expressed in + bushels per acre; if the right border yielded the most the result was considered *negative*, and the difference expressed in — bushels per acre.

The height of rows adjacent to the border rows of another plot were compared in the same way. If the variety near the left border was higher than the variety near the right border, the result was *positive*, expressed in + inches and centimetres; in the opposite case the result was *negative*, expressed in — inches and centimetres.

With the results obtained tables were drawn up showing the correlation between *difference in yield* and *difference in height*, such as the following (see p. 306), concerning barley.

The figures given in this table made it possible to calculate (by DAVENPORT'S formula) a very high negative coefficient of correlation:  $-r = -0.519 \pm 0.065$ . The height of the rows of barley adjacent to the border rows of a neighbouring plot thus has a decided influence on the yield in grain of these border rows; the greater this height the lower is the yield.

The same applies to winter wheat, where  $r = -0.337 \pm 0.097$ .

There is, however, but a very slight negative correlation or even a slightly positive relation in oats and spring wheat.

*Correlation between the difference in yield between the border rows of one variety and the difference in height of adjacent lines of other varieties.*

*Difference in yield of a border rows of the same variety (bushels per acre)*

	-9	-7.5	-6	-4.5	-3	-1.5	0	+1.5	+3	+4.5	+6	+7.5	+9	
-25							1			1				2
-20							1		1			1		3
-15								1		1		1		3
-10						1		1	2	1		1		6
-5					1	1	1	1	2	1			1	8
0			1	1	2	1	3		3	2				13
+5	2				2	3		1	1	1				10
+10	1	1					1							4
+15						1			1					2
+20					1			1						2
+25					1									2
+30				1	1									2
	3	1	2	3	8	7	7	5	10	7	0	3	1	57

The figures in the squares within the border represent the number of varieties showing such or such a combination between *difference in yield* and *difference in height*. The totals of these figures for each class are given outside the border on the right and at the bottom and give a total of 57 varieties, shown in the right-hand bottom corner.

B. — EFFECTS OF THE ADJACENT LINES ON THE YIELD OF THE BORDER ROWS OF A DIFFERENT VARIETY OF THE SAME SPECIES. — These effects were determined as in the preceding case. The results show them to be less than the effects produced by the height of adjacent lines. The negative coefficient of correlation was again highest for barley  $-r = -0.394 \pm 0.075$ , about 6 times the probable error, followed by that of spring wheat  $-r = -0.290 \pm 0.087$ . The other cereals had very low *positive* correlations, except in the case of winter wheat, where  $r = +0.315 \pm 0.099$ . These positive coefficients might be due to soil heterogeneity.

C. — VARIABILITY OF BORDER ROWS, CENTRE ROWS AND THREE-ROW PLOTS OF CONTROL PLOTS. — The cereals studied are Haynes Bluestem wheat, Turkey winter wheat, Ligowa oats and Manchuria barley. The border rows were found to vary much more than the centre rows, as the following figures, collected at the Minnesota Plant Breeding Nursery and Farm Crops Section, show,

Cereal	Experiment field	Difference between coefficient of variability of border and central rows
Haynes Bluestem wheat . . . . .	Plant Breeding Nursery . . .	$2.90 \pm 1.788$
	Farm Crops variety test . . .	$1.35 \pm 1.390$
Turkey winter wheat. . . . .	Plant Breeding Nursery. . . .	$2.74 \pm 1.509$
	Farm Crops variety test . . .	$0.94 \pm 1.838$
Ligowa oats . . . . .	Plant Breeding Nursery. . . .	$3.93 \pm 1.230$
	Farm Crops variety test . . .	$2.64 \pm 1.613$
Manchuria barley . . . . .	Plant Breeding Nursery . . .	$10.91 \pm 4.208$
	Farm Crops variety test. . . .	$3.63 \pm 1.386$

The greatest differences are between barley, then between oats; they are but slight in spring and winter wheat.

On the other hand, a comparison between the coefficients of variability of yield between the centre rows and the three row control plots gave the following results: —

*Oats.* — Negative differences, *i. e.* the yield of the centre rows varies less than that of the three-row plots.

*Barley.* — Very slight positive differences:  $-0.55 \pm 2.596$  and  $0.48 \pm 0.993$ .

*Winter and spring wheat.* — Marked positive difference:  $-1.65 \pm 1.313$  and  $2.94 \pm 1.699$  for the first, and  $0.61 \pm 1.215$  and  $2.95 \pm 1.535$  for the second.

In wheat, therefore, the average yield of the three-row plots varies less than that of the centre row, but the difference is not sufficiently great to justify the extra labour which would be required to compute the yield of the two border rows apart from that of the centre row.

From the results obtained the following conclusions were deduced:—

1) There is marked competition between rows 1 foot apart. In selection work, therefore, it is best not to sow only one row per ear, but to sow three-row plots, as the two border rows have a protecting action.

2) In calculating the yield it is unnecessary to consider all the three rows, but time and work may be saved by considering the centre row only as its variability is almost equal to that of the three rows together.

REPETITION OF TESTS IN ORDER TO REDUCE THE ERRORS DUE TO SOIL HETEROGENEITY. — In the experiments described the control plots were

also used to study the efficaciousness of such repetition. Three repetitions reduced error by 25 to 50 % ; 9 to 12, reduced the error to a minimum, making them almost negligible.

**275 - Correlations Observed in Continuously Cropped Barley, in U. S. A. —** See No. 289 of this Review.

**276 - A Method for Determining the Percentage of Self-Pollination in Maize. —** WALLER, A. E., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 1, pp. 35-37. Lancaster, Pa., January, 1917.

In the maize endosperm which results from fusion of the second nucleus of the pollen grain with the two polar nuclei, the yellow colour is dominant to the white. If, therefore, a white variety is fertilised with the pollen of a yellow variety, the resulting ears are hybrid, certain grains having the dominant yellow colour of the male parent, in accordance with the phenomenon called "xenia" (1) by FOCHE.

The author used this phenomenon as an indicator to estimate indirectly the degree of self-fertilisation in maize, applying it as follows: — in a field of yellow corn he placed, here and there, two or three plants of white maize. At the time of tasselling two of the three plants in each hill of white maize were detasseled; the third plant served to measure the degree of self-fertilisation on the basis that the white grains would be self-pollinated, the yellow grains the result of cross-pollination (xenia).

The varieties used were Reid's Yellow Dent and Wing's Hundred-Day White, which are particularly well adapted to cross-fertilisation since they flower about the same time. Of 36 ears, an average of 5.13 % were self-pollinated, but, for the reasons given in § 3, this does not represent the percentage of self-pollination which might take place under field conditions.

It should be remembered that: —

1) It is not always easy to distinguish the white grains from the yellow grains, which may be very pale. This is perhaps due to the formation in the endosperm of only *one set of yellow determinants*, brought by the second nucleus of the pollen grain, as against that of *2 sets of white determinants* contained in the double endosperm nucleus.

2) If, instead of comparing only 2 characters of the endosperm for colour (white and yellow, that is, one pair), the author had compared 2 *pairs* of characters, concerning, for example "colour" and "sugar content", the classification of the grain would have been greatly facilitated. It is, however, difficult to obtain sweet white varieties which flower at the same time as yellow field corn, and to do so a series of plantings would be necessary.

3) In the field the percentage of self-pollination is influenced by ex-

(1) When a female flower is fertilised by the pollen of another variety or species, the resulting fruit may show, in its endosperm, besides the embryo of the hybrid, also the characters belonging to the fruit of the male parent. In his work called *Die Pflanzenmischlinge*, FOCHE calls this phenomenon *xenia*. — See also BAUER, ERWIN, *Einführung in die experimentelle Pflanzenzüchtung*, p. 243. Berlin, 1911. (Ed.)

posure, spacing of rows, the direction and strength of the wind, atmospheric moisture, so that the sources of error can only be eliminated by repeating the experiments during several years.

**277 - The Relation of the Vigour of the Maize Plant to Yield.** — GRANTHAM, A. E., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 340-343. Washington, D. C., October, 1917.

The experiments described were carried out at the Delaware Agricultural Experiment Station, Newark, to ascertain the relation of the vigour of the maize plant to its yield in grain. Of two plants grown in the same hill, one was much stronger and vigorous than the other. About 100 such plants were chosen and grown under identical conditions, the hills thinned, and the stronger plant removed in 50 cases and the weaker one in the other 50 cases.

The two groups were distinguished by: — a) a considerable difference in the date of tasseling (August 5-12), the weaker plants being much later than the others; b) height, measured every 8 days after thinning, from June 25 to September 18. The extreme measurements were: — on June 25, 4.7 and 9.2 inches, and, on September 18, 98.0 and 107.3 inches respectively for the weak and strong plants.

The following table gives the most important results of the experiments: —

*Distribution of ears from strong plants and from weak plants.*

Weight of ear, grams	Number of ears		Weight of ear, grams	Number of ears	
	Strong stalks	Weak stalks		Strong stalks	Weak stalks
0-50	0	5	300-350	11	4
50-100	0	5	350-400	8	1
100-150	2	10	400-450	2	0
150-200	4	9	450-500	3	0
200-250	7	8	500-550	1	0
250-300	8	6			
				46	48

This table shows that strong stalks produce no ears under 100 gm. in weight, whereas, of 48 weak stalks, 10 produced ears weighing less than 100 gm. More than half the ears from strong stalks weighed more than 300 gm., while  $\frac{2}{3}$  of those from weak stalks weighed less than 200 gm. The strong plants are also distinguished by a higher yield in grain (221.7 gm. for strong stalks, 109.6 gm. for weak ones), the weight of the cob (41.7 gm. and 38.8 gm.), and a lower percentage of cob (19 and 24% respectively).

There is, therefore, a positive correlation between vigour and yield (1).

(1) The total weight of the plant is in direct ratio to the total weight of the caryopses (see also FRÜWIRTH, C., *Die Züchtung der landwirtschaftlichen Kulturpflanzen*, 2nd. Ed., Vol. II, p. 9, Berlin, 1909). (Ed.)

278 - Correlations between Ear Characters and Yield in Maize (1). — LOVE, H. H. and WENTZ, J. B., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 315-322. Washington, October 22, 1917.

A summary is first given of the results obtained by workers who, in selection for a given character, chose the two extremes, and sought to establish the relationship between this character and the yield (2). The author then describes his own experiments (at the Department of Plant Breeding, Cornell University, Ithaca, N. Y.) in which he chose, for each character studied, ears near the average type. The maize used was Cornell No. 12, a yellow dent variety selected from the Funk Ninety Day variety. In a table are shown the correlations obtained for all the characters in each of the 5 years during which the experiment lasted.

Below are given, in Table I, the general averages for the characters studied during the 5 years 1910-1914, and, in Table II, the mean percentage of grain in the ears of a few of the highest and lowest classes with the mean yield of these classes.

TABLE I. — *General averages of the characters studied.*

Ear characters correlated with yield per stalk	Average (1910-1914)
Length . . . . . cm.	21.382 $\pm$ 0.045
Average circumference. . . . . cm.	15.278 $\pm$ 0.027
Ration of tip to butt circumference. . . . .	0.859 $\pm$ 0.091
Average circumference of cob . . . . . cm.	9.289 $\pm$ 0.018
Weight . . . . . gm.	273.048 $\pm$ 0.978
Percentage of grain . . . . . %	85.252 $\pm$ 0.073
Average weight of kernels . . . . . gm.	0.283 $\pm$ 0.001
Number of rows . . . . .	17.004 $\pm$ 0.061
Average length of kernels . . . . . cm.	1.314 $\pm$ 0.003
Average width of kernels. . . . . cm.	0.798 $\pm$ 0.003
Yield per stalk . . . . . lbs.	0.727 $\pm$ 0.002

(1) See also R. February 1918, No. 148. (Ed.)

(2) WILLIAMS, C. G. (Corn Experiments, *Ohio Agricultural Experiment Station Bulletin* 282, 1915), selected ears for the maximum and minimum extremes of the characters length of ear, shape of ear, filling of tip, indentation of kernel, weight of ear and percentage of grain. In selecting long and short ears he obtained a difference of only 1.39 bushels per acre in a 10 year average yield in favour of long ears. In selection for shape of ear, tapering ears surpassed cylindrical ears in average yield during a 9-year period by 1.65 bushels per acre. Eight years' selection of bare and filled tips gave an average difference of 0.34 bushel per acre in favour of filled tips. Seven years' selection of rough and smooth dented ears gave an average difference of 1.76 bushels per acre in favour of the smooth type. Seed ears averaging 88.16 % of grain gave a 6-year average yield of 64.61 bushels per acre as compared with 65.06 bushels from ears averaging 76.38 % of grain.

HARTLEY, C. P. (Progress in Methods of Producing Higher Yielding Strains of Corn, *U. S. Department of Agriculture Yearbook*, 1909, p. 309), tabulated the yields of 4 varieties for 6 years, including 1000 ear-to-row tests. He found no relation between the characters of seed ears and yield.



TABLE II. — *Mean percentages of grain in the ears in a few of the highest and lowest classes, with the mean yields of these classes.*

Year	High classes		Low classes	
	Percentage of grain	Yield per stalk, pounds	Percentage of grain	Yield per stalk, pounds
1910 . . . . .	87.074	0.822	81.676	0.859
1911 . . . . .	88.565	0.624	79.375	0.677
1912 . . . . .	87.158	0.672	80.750	0.738
1913 . . . . .	88.447	0.602	80.714	0.847
1914 . . . . .	87.235	0.651	82.750	0.645
<i>Average . . .</i>	<b>87.596</b>	<b>0.692</b>	<b>81.053</b>	<b>0.753</b>

MONTGOMERY, E. G. (Experiments with Corn, *Nebraska Agricultural Experiment Station, Bulletin* 112, 1909), during many years selected ears for the characters shape of ear, shape of kernel and size of ear. He concluded the results were slightly in favour of long ears; the size of the ear depends too much on environment to be of any importance; a medium depth of kernel is to be preferred.

PEARL, RAYMOND and SURFACE, FRANK M. (Experiments in Breeding Sweet Corn, *Maine Agricultural Experiment Station, Bulletin* 183, 1910), carried out, from 1907-1909, a large number of ear-to-row tests with sweet corn. One of their conclusions is that there is no relation between the external seed characters and yield in sweet corn.

SCONCE, H. J. (Scientific Corn Breeding, *Proceedings of the American Breeders' Association*, Vol. VII, p. 43, 1911) tested Reid Yellow Dent and Johnson County White maize for 5 years. He found that ears of these varieties with 18 and 20 rows of kernels gave better yields than those with more than 20 or less than 18 rows. Averaging the results of 4 years he found that, with Reid Yellow Dent, the best yields were obtained with kernels having small germs, and with Johnson County White, with kernels having large germs. In correlating yield with shape of kernel he found that, in both varieties, square-shouldered kernels showing a small space between the rows at the crown and tip gave the best yields.

MCCALL, A. G. and WHEELER, C. S. (Ear characters not correlated with yield in corn, *Journal of the American Society of Agronomy*, Vol. V, p. 117, 1913), of Ohio State University, calculated the correlations between a few ear characters and yield and obtained the following results:

Characters correlated with yield	Coefficients of correlation	
	Series 1	Series 2
Length of ear . . . . .	0.0580 ± 0.0296	0.1017 ± 0.0651
Weight " . . . . .	— 0.0270 ± 0.0292	0.0866 ± 0.0656
Circumference . . . . .	— 0.0968 ± 0.0287	0.1803 ± 0.0636
Density . . . . .	0.0272 ± 0.0293	—

The ears used in this work had not been selected for the characters used in the correlations.

CONCLUSIONS. — 1) The characters, length, ratio of tip circumference to butt circumference, average circumference of cob, weight, average weight of kernels, number of rows of kernels and average length and width of kernels, do not show correlations significant enough to be of value in judging seed maize.

2) There is a slight negative correlation between percentage of grain in the ear and yield, implying that ears containing a low percentage of grain may yield higher than ears with a high percentage of grain.

3) The average circumference of the ear is the only character showing any significant relation to yield.

4) The external characters of the ears cannot serve as a basis for the choice of high yielding ears. The points on a show card are of no value for selecting seed ears, and apply exclusively to show purposes.

5) The only basis for selecting high-yielding seed maize is the ear-to-row progeny test.

LOVE, H. H. (The Relation of Certain Ear Characters to Yield in Corn, *Proceedings of the American Breeders' Association*, Vol. VII, p. 29. Washington, 1912), obtained the following correlations in experiments carried out over two years :

Ear characters correlated with yield per stalk	Minnesota No. 13		Funk Ninety Day	
	1909	1910	1909	1910
Length . . . . .	$-0.099 \pm 0.076$	$0.241 \pm 0.064$	$0.300 \pm 0.061$	$0.058 \pm 0.067$
Weight . . . . .	$0.094 \pm 0.076$	$0.015 \pm 0.068$	$0.323 \pm 0.060$	$0.090 \pm 0.067$
Number of rows . . . . .	$0.260 \pm 0.072$	$-0.127 \pm 0.067$	$-0.061 \pm 0.069$	$-0.034 \pm 0.067$
Weight of kernels . . . . .	—	$0.028 \pm 0.068$	—	$0.043 \pm 0.067$
Ratio of tip circumference to butt circumference . . . . .	—	$-0.162 \pm 0.066$	—	$0.014 \pm 0.067$
Percentage of grain . . . . .	—	$-0.177 \pm 0.066$	—	—

Thus the only characters showing any considerable correlation are length and weight of ear. Of the 8 correlations obtained for these two characters in the two years, two are about five times their probable error, so that these correlations can hardly be considered significant. (See also *B. May* 1912, No. 491).

CUNNINGHAM, C. C. (Relation of Ear Characters of Corn to Yield, *Journal of the American Society of Agronomy*, Vol. VIII, p. 188, 1916), of the Kansas Experiment Station, studied the relation of the ear characters to yield in a number of varieties. He found some variation for length of ear in the different varieties. In the small varieties the long ears yielded a little better than the medium and short ears, but this did not apply to the larger varieties. There was no significant difference in the averages for all varieties. Ears with small circumference out-yielded the large ears. There seems to be no relation between the filling out of the tips of the ears and yield. Smooth ears out-yielded the roughly dented ears. Ears with low percentage of grain yielded slightly higher than those with the higher percentages of grain. Ears with 16 and 18 rows of kernels generally gave the highest yields, though, in this character, there was a difference in varieties.

279 - **Breeding Sweet Corn Resistant to the Corn Earworm.**—COLLINS, G. N. and KEMPTON, T. H., in the *Journal of Agricultural Research*, Vol. XI, No. 11, pp. 544-572. Washington, December 10, 1917.

In the south of the United States and throughout the American tropics the production of sweet maize is greatly hampered by the ravages of the maize earworm (*Chloridea obsoleta* Fab., of the Noctuidae family), which are so serious that, in some districts, the place of sweet maize has been taken by the more resistant field varieties.

In order to unite in a new variety the character "sweet grain" of sweet maize and that of "resistance to earworm" of field maize, a series of hybridisation and selection experiments were carried out from 1912 to 1916 at Victoria (Tex.), Chula Vista, near San Diego (Cal.) and Lanham (Md.). Crosses were first made between the three commercial varieties of sweet corn, Stowell's Evergreen, Early Evergreen and Early Cory, and two varieties of field corn, Brownsville and Marrainto. Brownsville was selected for its resistance to earworm; Marrainto, a variety from northern Mexico, has rather thicker and harsher husks than those of Brownsville. From among the hybrids obtained the four following were chosen:

Ph 75 (Brownsville × Early Cory)

Ph 79 (Stowell's Evergreen × Brownsville)

Ph 77 (Early Evergreen × Brownsville)

Ph 80 (Marrainto × Early Evergreen).

From the beginning of the experiment the four characters considered as important in resistance to earworm were:—

1) *The distance which the husks extend beyond the tip of the ear*; as the larvae usually enter the ear from the tip of the shoot it is advantageous to increase the distance they must travel.

2) *The thickness of the cover of the husk*; as the larvae sometimes enter the ear through holes in the husk a thicker cover might hinder them.

3) *The texture of the husks*; in most sweet varieties the husks are relatively soft and smooth, while in field varieties they are firm and rough, sometimes even covered with firm spicules making their surface like sand-paper. This character might prevent the insects from eating through the husks.

4) *The husk leaves*; it was thought that ears without husk leaves might be less attractive to the moths.

The ears from the  $F_1$  contained a mixture of sweet and horny seeds. In 1914 the sweet seed from selected ears of each of the four above-mentioned hybrids were sown in separate rows at Lanham, one row for each ear. Pollinations were then made of plants of similar appearance, usually within the same row, the characters described being recorded for each plant. Preference was given to plants with long husks and few husk leaves, but other types, including a few that appeared inferior in worm-resistant characters, were not excluded. In 1915, 14 ears were selected and the grain from them sown at Chula Vista, where the earworm does more serious damage than at Lanham.

When the hybrids obtained in 1915 at Chula Vista were compared with other varieties of sweet maize growing in the neighbourhood, the hybrids were found to have suffered less than the other varieties. All condi-

tions being equal, and the effect of competition in adjacent lines (1) being taken into consideration, some lines showed greater resistance than others; thus, the hybrid Ph 124 (Stowell's Evergreen  $\times$  Brownsville) was  $7\frac{1}{2}$  times more resistant than Ph 125 (same cross). This proves that *different plants from the same ear are distinguished by a special degree of resistance.*

In 1916, 35 rows were planted at Lanham, distributed as follows: —

14 rows of the 1915 hybrids.

9 from ears obtained by hand pollinations within the rows of the 1915 row.

8 rows from ears obtained by crosses between the rows in 1915.

2 rows of  $F_1$  crosses between 1915 lines and Hopi maize

1 row of Oregon Evergreen (P 129), a commercial variety of sweet maize

1 row of New Century Wonder (P 125), a commercial soft variety sold as table maize.

The results confirm those of 1915. Ph 124 retained its superiority, showing the character "*resistance to earworm*" to be *hereditary*. Moreover, the degree of immunity may increase from one generation to the other as is shown by the correlation  $0.66 \pm 0.09$  for damage done by earworm. On the other hand, three varieties of sweet maize used for comparison, Oregon Evergreen, one of the most resistant commercial varieties of sweet maize and two Hopi hybrids, Ph 137 and Ph 141, were seriously injured by the parasite.

#### CHARACTERS CORRELATED WITH RESISTANCE: —

1) *Damage*, expressed by a scale from 1 to 10, where 10 expresses complete destruction of the ear.

2) *Number of larvae*.

3) *Damage per larva*.

4) *Prolongation of husk*; the distance from the tip of the ear to that of the husk expressed in centimetres.

5) *Length of ear*.

6) *Length of husks*.

7) *Number of husks*.

8) *Number of layers forming the husk*.

9) *Number of days from planting to silking*.

10) *Maturity*; the proportion of opaque to transparent endosperms estimated in a section of the grain, according to a scale of from 6 to 15; below 6 the grain is not marketable.

11) *Number of days from silking to harvest*.

12) *Husk leaves*; the development is in accordance with a scale of 1 to 10.

13) *Number of rows*.

The correlation of the characters *prolongation, length of husks, number of layers, days to silking, to damage* are expressed by coefficients equal to or above 0.35. There is positive correlation between

*Prolongation and Length of husks.*

*Length of husks and Length of ear*

*Number of husks and Number of layers*

*Number of layers and Days to silking.*

*Days to silking and Maturity, Days from silking to harvest, Husk leaves.*

*Maturity and Days to harvest, Husk leaves.*

These correlations must be borne in mind so that an eventual immunising effect may not be wrongly attributed to one of a pair of correlated characters.

**ANALYSIS OF RESULTS. — Prolongation of husks.** — One of the chief differences between sweet maize and field maize is the greater length of the husks which greatly exceed the lip of the ear in the latter; the larvae of the earworm must thus travel a greater distance to reach the tip. This explains the greater resistance of the field variety. A correlation between *damage* and *length of husk* is, therefore, to be expected. Such a correlation of  $0.71 \pm 0.06$  is, indeed, found, whereas the relation of *regression of damage* (1) to *length of husk* is expressed by the coefficient 1.02, i. e. an increase of 1 cm. in prolongation may save 1 % of the crop. Amongst 14 progeny with an average prolongation of 2.9 cm. there was a loss of 10 %, and among 12 with an average prolongation of 7.7 cm. the loss dropped to 5 %. In other words, an average increase of 4.8 cm. in prolongation was accompanied by an average reduction of 5% in damage (or about  $\frac{1}{100}$  per centimetre).

**Number of layers and number of husks.** — The coefficient of correlation between this character and damage is high — 0.52 — but as only 4.5% of the larvae enter the ear by penetrating the husks, there cannot be said to be any direct relation as to cause and effect between the number of layers and damage. The protective effect of the layers is also partly due to *another character* correlated with thickness which has not been considered in these experiments (partial correlation).

**Husk leaves.** — The larger the leaves the larger the space over which the moth can deposit eggs. The positive correlation between damage and husk leaves is  $0.31 \pm 0.11$ . In selection, therefore, forms with very large husk leaves should be avoided.

(1) When the coefficient of correlation between 2 characters and the standard deviation of each is known the *coefficient of regression* may be easily calculated. For example, to obtain the coefficient of regression of the weight of the ear as related to its length, the coefficient of correlation between *weight* and *length* is multiplied by the standard deviation from the average weight, and the product divided by the standard deviation from the average length, using the formula  $r = \frac{\sigma_w}{\sigma_l}$ , where  $W$  represents the weight in ounces and  $L$ , the length in inches.

Similarly, to calculate the coefficient of regression of the length as related to the weight, the formula  $r = \frac{\sigma_l}{\sigma_w}$  is used. Supposing, for example, that the coefficient of regression of the weight as related to the length is 2.03 and that, in certain groups of ears in a field, the deviation from the average length of the group in relation to the average length of the crop is 2 inches, by multiplying this deviation by the coefficient of regression, these ears may be said to weigh  $2 \times 2.03 = 4.06$  ounces more than the average weight of the ears of the crop.

The coefficient of regression thus gives a specific relation between the standard deviation of 2 correlated characters, so that, if the standard deviation of one of them be known, it is easy to calculate the standard deviation of the other. — Cf. DAVENPORT, E., *Principles of Breeding*, pp. 466-368. (Ed.)

*Number of larvae and damage per larva.* — These values are low in resistant lines. As the number of larvae depends greatly on the degree of attraction of the plant for the female moth, it may be assumed that the plants avoided by the moths are those most distasteful to the larvae. It is probable that this agreement between the instinct of the larva and the moth depends less on the morphological characters of the plant than on chemical differences, probably on the presence of some volatile substance distasteful both to the larva and to the moth. We have, therefore, one of the characters which have not been considered in these investigations, although it is closely correlated with damage.

*Other characters.* — The coefficients of correlation are low and of no importance in practical selection.

**CONCLUSIONS.** — 1) An increase in the length and thickness of the husk covering, and a reduction of the husk leaves increase resistance to earworm.

2) By crossing sweet maize and field maize varieties, the characters "sweet grain" and "resistance of the ears to earworm" may easily be united in one variety in ever-increasing proportions.

**280 - Correlations Observed in Maize Grains, in U. S. A.** — See No. 271 of this Review.

**281 - Inheritance of Abbreviation of Growth in the Cultivated Carrot and Beet.** — DANIEL, LUCIEN, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 25, pp. 1012-1014. Paris, December 17, 1917.

In 1916 the author described his studies on certain nutrition modifications caused by the sea climate and sandy soil in plants transferred from Rennes (Ille-et-Vilaine) to Erquy (Côtes-du-Nord), by the sea (1). He showed that most of these variations were not hereditary, but disappeared with inland cultivation. He extended his observations to the study of the inheritance of other phenomena which appear to be more frequent on the coast, particularly the inheritance of abbreviated growth in carrots and beet, which sometimes give annual plants of no, or of only very minimum, utilitarian value.

(1) DANIEL, LUCIEN, Cultures expérimentales au bord de la mer, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXIII, No. 18, pp. 483-486. Paris, Oct. 30, 1916.

The author summarised as follows the results of his experiments carried out during 15 years at Erquy: —

1) In 15 years the plants transferred from Rennes to the coast at Erquy, acquired no halophytic characters although subjected to the influence of fog and occasional watering with salt water.

2) The only distinct variations were those caused by the very marked oscillations of the water (quantity, quality and salt content), which caused dwarf and giant plants and all the intermedite stages. This action is entirely transitory, both in the experimental plants themselves and in their descendants. It does not appear to be hereditary so far as can be judged from the negative experiments and their short duration (15 years) as compared with repeated action during many centuries. Giant or dwarf plants, so common on the sea coast according to the degree of moisture at the station, rapidly lose their peculiar characters inland, thus again confirming the non-inheritance of these phenomena.

His experiments, which are still being continued, were carried out simultaneously at Rennes and at Erquy and gave the following results: —

1) The abbreviation of growth is partially hereditary, to a degree varying with the conditions of cultivation in a first generation ;

2) The sensibility to the variation is specific and greater in the variety of carrot studied than in that of beet ;

3) The abbreviation of growth varies with the individual and may be accompanied by unexpected variations showing that the stability of the race has been deeply shaken ;

4) Care must be taken not to use seed of annual carrots and beets ; the mixing of such seeds with pure ones should be suppressed.

282.— The Selection of Some Varieties of Swede Resistant to *Plasmodiophora Brassicae*, in Denmark. — CHRISTENSON, C. I., in *Tidskrift for Planteavl*, Vol. XXVI, Part. 1, pp. 68-82. Copenhagen, 1917.

The English variety Pioneer, of Driffield, Yorkshire, is known to be resistant to the attack of *Plasmodiophora Brassicae*, which causes great damage to swedes in Denmark every year. For this reason, the discovery of two new varieties of swede more resistant than Pioneer to the disease, is worthy of special notice.

One was isolated from the type-variety Klank belonging to the "Trifolium" Society of Copenhagen ; the other came from the Studsgaard Experiment Station. The article describes the results of a series of selections carried out at Studsgaard during 1909-1916, with excellent results. In the autumn of 1908, the author collected 18 healthy, well-developed specimens from plots very badly damaged by *Plasmodiophora*. Some of these choice specimens went bad during the winter ; 11 remained and were planted in the spring of 1909, well isolated to prevent cross-fertilisation.

Sufficient seed was collected from 10 of the plants to allow study of the progeny. The aim was to ascertain whether resistance to *Plasmodiophora* is hereditary. Ten families were named, one for each seed plant: Bangholm Fam. 1, Fam. 2, etc. The seed was sown on plots that had produced swedes for the two previous years that were badly attacked by *Plasmodiophora*. The results for 1910 are given in Table I. The progeny are divided into 3 groups: 1) perfectly resistant ; 2) slightly attacked, but the 'root' retains its form and can be fed to cattle ; 3) badly attacked, the 'root' being completely spoiled. Column 8 in the table shows the degree of intensity of the attack for each family, calculated according to the formula:  $K = \frac{0 \cdot a + 1 \cdot b + 2 \cdot c}{n} \times 10$ , where  $a$  equals the number of unat-

tacked roots,  $b$ , the number of slightly attacked roots,  $c$  the number of badly attacked roots, and  $n$ , the total number ( $a + b + c$ ) of roots.

The progeny of 87 roots, chosen with no criterion of immunity, and crossing under similar conditions, and quite near to the experimental plots, were almost completely destroyed by *Plasmodiophora*: degree of intensity of the attack = 14. The attack was much reduced in the case of the 10 Bangholm families coming from resistant plants; the intensity being 4

(maximum) given by Fam. 1 and 2, and 0.4 (minimum) given by Fam. 4, which was also notable as being almost completely immune.

The 1912-1913 Experiments confirmed those of 1910. During this time, by means of continuous and minute selection in the Studsgaard experimental fields, some lines were isolated that had a high degree of resistance, as was shown by trials in 1914, 1915 and 1916.

TABLE I. — *Demonstration of the transmissibility of the character "resistance to Plasmodiophora Brassicae". 1910 results.*

	Number of roots per plot				No. of roots %				Kg. of roots per plot			
	immune	slightly attacked	badly attacked	Total	immune	slightly attacked	badly attacked	K = intensity of attack 0—20	immune	slightly attacked	badly attacked	Total
Pioneer. . . . .	24.6	1.7	2.7	29.0	85	6	9	2	15.6	0.9	0.4	16.9
Bangholm (ordinary) . .	5.3	8.3	15.4	29.0	18	29	53	14	3.3	6.2	3.2	12.7
Bangholm, Fam. 1 . . .	21.4	3.3	3.3	28.0	76	12	12	4	13.8	2.9	1.2	17.9
» » 2 . . .	23.3	5.0	2.0	30.3	77	16	7	3	12.7	2.1	0.2	15.0
» » 3 . . .	23.3	5.0	0.7	29.0	81	17	2	2	16.8	1.9	0.2	18.9
» » 4 . . .	29.0	1.3	0.0	30.3	96	4	0	0.4	19.6	0.9	0.0	20.5
» » 5 . . .	24.3	3.7	2.3	30.3	80	12	8	3	22.1	2.0	0.4	24.5
» » 6 . . .	22.3	1.7	1.3	25.3	88	7	5	2	18.1	0.9	0.4	19.4
» » 7 . . .	23.3	2.7	3.0	29.0	81	9	10	3	16.6	1.7	0.5	18.8
» » 8 . . .	23.0	3.0	2.7	28.7	80	11	9	3	18.6	2.2	0.5	21.3
» » 9 . . .	21.0	5.0	4.0	30.0	70	17	13	4	17.6	2.9	0.9	21.4

TABLE II. — *Table showing the degree of resistance of the progeny (1916).*

	Hundreds of roots per hectare				Number of roots %				K = intensity of attack 0—30
	immune	slightly attacked	badly attacked	destroyed	Total	immune	slightly attacked	badly attacked	destroyed
Bangholm Fam. 4. . .	444	76	9	4	533	83	14	2	1
» » 25. . .	421	63	8	21	513	82	12	2	4
» » 19. . .	387	108	15	9	519	74	21	3	2
» » 21. . .	374	106	20	20	520	72	20	4	4
» » 26. . .	356	88	40	22	506	70	18	8	4
» » 3 . . .	309	127	56	19	511	60	25	11	4
Bangholm Pajberg III (ordinary type)	15	194	148	93	450	3	43	33	21



In Table II (1916), in order to find the value of  $K$ , the progeny are divided into 4 groups: — 1) immune; 2) slightly attacked; 3) heavily attacked; 3) almost completely destroyed. The formula  $K = \frac{0.a + 1.b + 2.c + 3.d}{n} \times 10$  is used, where  $d$  equals the number of plants entirely destroyed ( $a$ ,  $b$ ,  $c$  and  $n$  as in the preceding formula).

Among the new forms, Fam. 25 and 19 deserve attention both for high resistance and yield (see Tables II and III). They come close to Fam. 4, which, however, always maintains its first place. This shows the excellent results obtainable by individual selection.

TABLE III. — *Data on the 1916 root crop.*

	Dry matter per hectare, in quintals	Roots per acre, in quintals				% of dry matter
		immune	slightly attacked	badly attacked	Total	
Bangholm Fam. 4. . .	83.7	486	87	4	577	14.5
" " 25 . . .	80.6	506	76	2	584	13.8
" " 19. . .	74.0	432	117	7	556	13.3
" " 3. . .	73.7	364	120	24	508	14.5
" " 26. . .	69.6	399	85	17	501	13.9
" " 21. . .	67.9	363	93	12	468	14.5
Bangholm Pajberg III (ordinary type) . . .	49 0	13	271	99	383	12.8

283 — **Flaxwilt: A Study of the Nature and Inheritance of Wilt Resistance.** — TISDALE, W. H., in the *Journal of Agricultural Research*, Vol. XI, No. 11, pp. 573-605, plates 44-46. Washington, December 10, 1917.

The experiments described were carried out in February, 1915, at the University of Wisconsin. Crosses were made between a variety of flax resistant to wilt (*Fusarium lini* Bolley) — North Dakota Resistant 114, designated in the article as No. 4 — with 3 other varieties more or less susceptible to the disease, namely, No. 3, from Dakota, No. 5, with white flowers from Red Wing, Minn., No. 6, from Devil's Lake, N. Dakota., and the behaviour of the hybrids obtained observed.

Only one of the crosses, that between the resistant variety No. 4 and the most susceptible variety, No. 3, gave results which could be explained by a Mendelian formula. The resistant plant was used as female parent, and the progeny designated as 4 D 20, where 4 represents the strain, D the plot on which it was grown, and 20 the number of the female plant. The 26  $F_1$  hybrids thus obtained remained perfectly healthy, whereas the No. 3 control plant wilted entirely. In the  $F_2$ , of 530 plants, 162 were resistant and 368 wilted, giving a ratio which makes it impossible to attribute the character "resistance to wilt" to one single factor. If, however, 4 factors are concerned, these figures (or rather their halves, 81 and 184) are close

to the theoretical figures, 81 resistant to 175 susceptible, corresponding to the Mendelian ratio 1 : 2.16.

However, as has already been said, this cross was the only one the results of which could be explained; in all the others the ratio between resistant and susceptible plants varied so greatly that it could not be accounted for by admitting a constant number of factors. In the  $F_1$  were obtained both more or less resistant plants and very susceptible plants, but, in most cases, intermediate forms, expressed by very varying factors. It must be pointed out that some of the hybrids with the same degree of susceptibility (percentage of dead plants at the end of the experiment) as the susceptible parent plant sometimes showed a marked difference from this parent as to the date of starting, rapidity and duration of the infection; in some plots of susceptible hybrids the first symptom of disease only began to appear when the control parent plants were already wilted to a large extent.

It must be noted that the environmental conditions during the experiments were far from uniform especially as regards the state of the soil, which was sometimes naturally and sometimes artificially infected, thus affecting the resistance of the plants. It seems possible that the complex phenomena observed in these hybridisation experiments may be explained by the specific action of external factors on resistance to wilt. The resistant strain No. 4 was selected to withstand the disease under normal environmental conditions. In this case the factors A, B, C, D, are sufficient to produce immunity, so long, of course, as they are homozygous (AA, BB, CC, DD). When, however, extraordinary conditions (temperature, inoculated soil) favourable to the growth of the parasite are artificially created, the action of A, B, C, D, becomes insufficient, and part at least of the hybrids, resistant under normal conditions, break up into resistant and susceptible plants. In such cases, to regain immunity, other factors, E, F, etc., must be taken into consideration. This has evidently not been done for strain No. 4, selected for growth under normal conditions. The factors in this line may be: — 1) entirely absent, 2) present singly, 3) present in combination, either homozygous or heterozygous. The differences in the results obtained would be thus explained.

The wilting of the plants attacked is due to the combined action of the following factors: — 1) destruction of the root system; 2) use of the food and water supply of the plant by the fungus; 3) more vigorous growth of the fungus and increased transpiration of the host plant due to a rise in temperature; 4) the possible production by the fungus of toxins injurious to the host protoplasm. What is the specific behaviour of the resistant plants towards the pathogenic agent? The mycelium penetrates the root hairs, epidermal cells, the stomata of seedlings, and perhaps also wounds, of both resistant and susceptible plants. In the latter it develops rapidly, killing the tissues, whereas, in the former, it is unable to penetrate the tissues. This may be due to: — a) the permanent chemical composition of the resistant plant may be injurious to the fungus, b) the protoplasm of the resistant plant may be more sensitive than that of the susceptible

plant. thus reacting more readily in the production of the phenomena causing wilting; c) below and around the point attacked the cells of the parenchyma, which form a fourth layer, divide and thicken their walls with a substance giving the suberin reaction; the cork layer thus formed isolates the infected zones, preventing further progress of the hyphae.

284 - **Selection of Pea-seed.** — BEVERLEY, J., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, p. 216. Wellington, New Zealand, October, 1917.

The experiments were carried out to ascertain whether the number of peas in the pod has any influence on the vigour and yield of the future crop. The results for the season 1916-1917 were: —

Variety	Number of peas in pod	Plant vigour expressed	Seed yield expressed
B. verley's No 1 pea.	Average: 8 or less	100	100
	Once selected: 10	105	140
	Twice selected: 10	105	156

The results are positive and clearly show the effect of selection. The seed from pods containing 10 produce better developed and more productive plants than those from pods containing 8 or less. The seed from the 1st. generation of pods containing many peas gives a yet higher yield in the 2nd. generation.

285 - **Asparagus Selection in Massachusetts, U. S. A.** — *Twenty-Ninth Annual Report of the Massachusetts Agricultural Experiment Station, Public Document No. 31*, pp. 23-24. Boston, January, 1917.

The asparagus selection work at the Concord Substation, Massachusetts, is in charge of Prof. J. B. NORTON. Starting with the common commercial varieties he successfully isolated strains distinguished, not only by their vigour, and the quality and quantity of their produce, but also by marked resistance to rust (*Puccinia Asparagi* D. C.).

For testing purposes were distributed: — in 1915, to 99 growers, 68 lots of roots of 50 each, and 217 ounce packets of seed; in 1916, to 74 growers, 67 lots of roots of 100 each and 43 ounce packets of seed of the new varieties.

All the reports were favourable, both as regards the produce and the rapidity and vigour of growth. In no case was rust reported, but, in view of the relative freedom from rust attacks in 1915-1916, the results of further tests must be awaited before any definite opinion as to immunity to this disease can be passed.

286 - **Hybrid Chestnuts in the United States.** — MURRILL, W. A., in the *Journal of the New York Botanical Garden*, Vol. XVIII, No. 214, pp. 213-215. Lancaster, Pa., October, 1917.

The paper refers to certain chestnut hybrids obtained and cultivated by Mr. VAN FLEET in his experimental grounds several miles to the north-

east of Washington. The following lines were used for propagation and study: American chinquapin chestnut (*Castanea Chincapin* Hort. = *pumila*), Japanese chestnut (*C. japonica* var. *pubinervis* Makino), and Chinese chestnut (*C. chinensis* Hassk. = *C. sativa*).

CHINQUAPIN × JAPANESE. — Among the hybrids were found all the stages intermediate to the large, sweet chinquapin and the Japanese type with fruit fine, but of poor flavour and good only for cooking. The more chinquapin stock present, the better is the flavour. All these hybrids were immune from chestnut canker or blight (*Diaporthe parasitica* Murr.), and some produced excellent fruit.

CHINQUAPIN × CHINESE. — The use of the Chinese chestnut is to be recommended because of its sweet, soft-skinned nut, much larger than that of the chinquapin. These hybrids, however, are not immune to canker, which sometimes attacks the trees very seriously. It seems best to grow them in shrubs with several trunks, so that, if one is attacked, it may be cut immediately and its place taken by another.

Mr. VAN FLEET's hybrid chestnut plantation covers an area of about 4 acres. The trees are planted at distances of 6 to 8 feet from each other in rows 12 feet apart.

CEREAL  
AND PULSE  
CROPS

287 - Winter Wheats in the United States. — See No. 257 of this Review.

288 - The Characters and Yields of Australian Wheats. — See No. 342 of this Review.

289 - Some Effects of the Successive Cropping of Barley. — GERICKE, W. F., in the *Journal of the American Society of Agronomy*, Vol. IX, No. 7, pp. 325-332. Washington, D. C., October, 1917.

The experiments described, carried out in the Laboratory of Soil Chemistry of the University of California, Berkeley, form part of a study undertaken to investigate the effects of successive cropping of barley on soil in pots under greenhouse conditions. All the factors of production, except the soil, were the same or similar throughout the experiment. Five kilograms of soil were put in each pot, some of which were sown and some

TABLE I. — Yield and ripening, as affected by successive cropping.

Number of crops in one soil	Number of stalks				Period of harvest	
	total per pot	grain producing	producing heads but no grain	producing no heads	first heads ripe	last heads ripe
4 . . . .	5	5	0	0	June 1	June 11
4 . . . .	6	6	0	0	June 1	June 11
3 . . . .	20	6	6	8	June 15	July 7
3 . . . .	12	6	4	2	June 15	July 8
2 . . . .	21	6	10	5	June 15	July 10
2 . . . .	23	8	9	6	June 14	July 10
1 . . . .	29	13	11	5	June 15	July 8
1 . . . . .	40	10	16	14	June 16	July 12

left unsown; so that a series was obtained in which some had produced three crops, some two, some one, and some no crop. Throughout the experiment the culture and water content of the soil was the same for each pot whether it contained growing plants or not. The soil was well supplied with the necessary plant-food constituents and was particularly rich in nitrogen. Analysis by the strong acid digestive method showed it to have the following composition: — insoluble residue, 64.85 %; soluble silica, 9.18 %; Ca O, 2.26 %; Fe<sub>2</sub>O<sub>3</sub>, 45.9 %; Al<sub>2</sub>O<sub>3</sub>, 5.80 %; SO<sub>3</sub>, 0.4 %; Mn<sub>2</sub>O<sub>4</sub>, 0.13 %; Mg O, 0.72 %; K<sub>2</sub>O, 0.62 %; Na<sub>2</sub>O, 0.43 %; P<sub>2</sub>O<sub>5</sub>, 0.48 %; loss on ignition, 11.94 %; total nitrogen, 0.31 %; humus, 3.20 %; nitrogen in humus, 3.30 %.

The seed used was from a very pure strain of Beldi barley. The appended tables show the results of the experiments.

TABLE II. — *Average height in centimetres of the different classes of stalks as affected by successive cropping.*

Number of crops in one soil	Average height of all stalks	Average height of grain-producing stalks	Average height of stalks producing heads but no grain	Average height of stalks producing no heads
4 . . . . .	68.6	68.8	—	—
4 . . . . .	66.6	66.6	—	—
3 . . . . .	40.7	53.2	29.2	40.1
3 . . . . .	38.2	42.5	27.5	53.0
2 . . . . .	35.1	49.7	31.8	24.4
2 . . . . .	31.6	41.2	29.6	22.7
1 . . . . .	31.1	38.6	25.8	23.4
1 . . . . .	28.9	49.0	29.0	20.3

TABLE III. — *Relation of height of stalk to weight of grain as affected by successive cropping.*

Number of crops in one soil	Pot 1				Pot 2			
	Height of stalk cm.	Number of kernels in head	Weight of kernels in head		Height of stalk cm.	Number of kernels in head	Weight of kernels in head	
			total gm.	average of 1 kernel mgm.			total gm.	average of 1 kernel mgm.
4 (average of 6 stalks) . .	68.6	26.2	1.311	30.0	66.6	29.1	1.387	47.5
3 (average of 6 stalks) . .	53.1	21.6	1.019	47.0	42.5	19.7	0.894	45.4
2 (average of 8 stalks) . .	49.7	28.7	1.074	37.5	41.2	17.2	0.711	41.2
1 (average of 13 stalks) . .	38.6	15.9	0.665	41.8	40.9	17.2	0.731	42.5

CONCLUSIONS: 1) Plants of the 4th. crop matured with a greater uniformity than those of any other crops. None of them had barren stalks. The number of tillers and barren stalks increased with the plants grown in soil which had produced a lesser number of crops.

2) The total height of all the stalks produced decreased with each successive crop, but the average height of the individual stalks increased with each successive crop.

3) In the 4th. and 3rd. crops the heaviest grain, both in weight per head and in average weight per kernel, varied with the height of the stalks. The tallest stalks produced the largest ears and highest average weight per kernel.

4) In the 2nd. and 1st. crops there was no correlation between the height of stalks and weight of grain per head or average weight per kernel.

290 - Studies on Maize in the United States: Influence of Position of Grain in the Cob on the Growth of Maize Seedlings. — See No. 271 of this Review.

291 - The World's Production of Rice. — See No. 251 of this Review.

292 - The Utilisation of the Civet Bean (*Phaseolus lunatus*) Cultivated in Madagascar. — PRUDHOMME, E. and RIGOTARD, L., in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 5, p. 6. Paris, January 29, 1918.

During the last 15 years the cultivation of the civet bean in Madagascar has increased considerably and it is exported in ever-growing quantities; from 17 700 cwt. in 1910 the exportation has risen to nearly 177 000 cwt.; the 1917 harvest is estimated at 196 800 cwt.

The authors discuss the value of the civet bean as a food. It is particularly appreciated in England, where, under the common name of "butter bean", it is eaten like the ordinary dried bean, and is even considered a choice food.

The authors have recently examined many samples of civet beans at the Colonial Garden. The results of the examination of many varieties confirm the statement that large, flat, white seeds, or those with pink spots at the end or near the hilum, about 22 to 24 mm. long, 13 to 15 mm. wide and 6 mm. thick, only contain from 5 to 7 mgm. of hydrocyanic acid per 100 gm. of seed. The average weight of 100 such seeds is between 115 and 189 gm.

Mr. KOLN ABREST, Director of the Laboratory of Toxicology of the Paris Police Service, supplied the authors with data which prove the civet beans grown at Madagascar to be those of all the numerous varieties of *Phaseolus lunatus* which yield the least hydrocyanic acid. They may be eaten without any danger as is shown by the quantities of acid found on analysis: — 100 gm. of beans of this quality contain barely 2 to 3 mgm. of hydrocyanic acid, if the water in which they are soaked and cooked is thrown away. This amount is harmless to adults.

The sale of the beans should be controlled and the hydrocyanic acid content limited to 10 mgm. per 100 gm. of beans. For this it would be sufficient according to the author's studies, to limit the importation to large, flat seeds, the weight of which varies from 1 000 to 15 000 gm. per 1 000 seeds, either entirely white in colour, or slightly mottled with red or pink.

293 - Winter Potato Growing in the Algerian Sahel. — BESSON, ANTOINE, in the *Bulletin de la Direction Générale de l'Agriculture, du Commerce et de la Colonisation de la Régence de Tunis*, Year **XXI**, No. 90, pp. 22-41. Tunis, 1917.

STARCH CROPS.

In view of the increasing cultivation of the potato in Algeria for export and the absolute lack of sufficiently detailed literature on the subject for the use of the farmer, the author gives information he has been able to collect by his own experiments and numerous observations on the cultivation of the early potato.

To obtain good results planting must be early, which, moreover, allows a second crop of tobacco, maize or red potato. The potatoes may be planted between rows of vines; the cultural methods and fertilisers indispensable to the potato also benefit the vine, and, as the potatoes are lifted before the vine shoots appear the care of the latter can proceed normally.

A detailed study is made of: — 1) choice of land, 2) preparation of the soil, 3) live or dead shelter-hedges, 4) choice of seed (the varieties most to be recommended are: Grenadine or native potato; Royale Kidney hâtive or La Hâtive; Royale Kidney Allemande or Belle de Juillet, harvested in France; Royale Kidney Allemand or Belle de Juillet, harvested in Germany; Flouque de Jersey; Hainaut or Belle de Fontenay); 5) sprouting of the potato, 6) planting, 7) watering, 8) copper sulphate spraying, 9) cultivation, 10) lifting, 11) sorting, 12) fertilisers.

294 - A "Water-Potato". — ROSS, D. M., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 4, pp. 209-210. Wellington, October, 1917.

In the Bay of Plenty district, New Zealand, on the northern bank of the Rangitaiki River, near a fresh water spring, a strong variety of edible potato is found growing amongst watercress (*Nasturtium officinale*). The roots and tubers of the plant are found from 12 to 17 inches below the water. The potatoes are of fair size and ripen as early as August; when cooked they are waxy.

The author sent some of the tubers to the Moumahaki Experimental Farm to see if they could be grown on dry land. Planted on August 31, 1916, they gave vigorous plants with distinct foliage and large blue flowers which bore seed-apples. The crop was lifted on February 6, 1917, and was free from disease. The yield was 12.87 tons per acre, 11 tons of which are marketable (table and seed) and 1.87 tons were pig-potatoes. Boiling tests showed that the potatoes kept their colour well but could not be classed as good cookers. The starch content appears to be high.

295 - Three Fodder Pulses of Bihar and Orissa: Meth, Bhringi and Mashyem Kalai. — GOSH, A. C., in *Department of Agriculture, Bihar and Orissa, An Agricultural Journal*, Vol. V, No. 1, pp. 15-47, 14 tables, 5 plates. Patna, 1917.

FORAGE CROPS  
MEADOWS  
AND PASTURE

A systematic study has been made of the pulse crops grown in the botanical experimental area at Sabour (Bihar and Orissa, India). A botanical description and detailed observations are given of the different varieties, natural crosses, soil, sowing, cultivation, uses, etc.

Some of the most important data on Meth (*Phaseolus Ricciardianus* Ten.), Bhiringi (*Phaseolus aconitifolius* Jacq.) and Mashyem Kalai (*Phaseolus calcaratus* Roxb.) are given in the following table.

	<i>Phaseolus Ricciardianus</i> ( <sup>1</sup> )	<i>Phaseolus aconitifolius</i> ( <sup>2</sup> )	<i>Phaseolus calcaratus</i>
Length of main stem . . . . .	1-2 ft.	1-3 ft.	16-27 inches
Yield } green fodder (average of 3 tests) .	10323 lbs.	3 700 lbs.	10 057 lbs.
per acre } grain . . . . .	523 lbs	—	532 lbs.
<i>Composition of green fodder:</i>			
Water . . . . .	62.73 %	50 %	70.29 %
Albuminoids . . . . .	5.02	6.94	3.97
Amides . . . . .	1.53	1.13	0.93
Crude fibre . . . . .	3.18	4.25	3.42
Ash . . . . .	5.11	8.91	3.42
Silica in ash . . . . .	1.65	4.88	0.93
Digestible carbohydrates . . . . .	22.43	28.77	17.97
<i>Composition of unhusked seed:</i>			
Moisture . . . . .	8.10 %	8.65 %	( <sup>2</sup> ) 9.85 %
Ether extract . . . . .	0.50	0.68	0.38
Albuminoids . . . . .	21.52	22.38	20.12
Nitrogen in albuminoids . . . . .	3.46	3.58	3.27
Crude fibre . . . . .	6.38	3.88	4.33
Digestible carbohydrates . . . . .	59.62	60.59	60.61
Ash . . . . .	3.87	3.83	4.33
Silica in ash . . . . .	0.07	0.07-0.1	0.002-0.003

(1) Yellow seed variety. — (2) Black mottled seed variety.

USES. — *Ph. Ricciardianus*. — Chiefly grown for green fodder. The seeds, though indigestible, are used as human food; entire or partly crushed seeds steeped in water overnight are given to cattle and horses. The straw and husks are used as a food for cattle.

*Ph. aconitifolius*. — The seed is used for human consumption. The pod husks and straw are fed to cattle.

*Ph. calcaratus*. — Grown particularly for green fodder. The seed, if first baked and crushed, may be used for human consumption.

296 - Grass Experiments at Hawkesbury Agricultural College, 1916-17. — KERLE, W. D., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 2, pp. 809-813. Sydney, November, 1917.

The year ending June 30, 1917, was exceptionally dry. The rainfall was 29.610 inches, nearly half of which fell during the three months October-December.

The experiments were divided into two series: 1) rows of 116 links in length and 2 1/2 feet apart, 2) field plots of 1/4 acre.

The first trials, besides their use for study and instruction, had as aim, a) to determine the suitability to the district of the common native and intro-



duced grasses; b) to determine the value of newly-introduced grasses; c) to improve varieties by selection.

The second trials aimed at: — a) testing under ordinary field conditions those varieties which had given good results in the row trials; b) to establish seed reserve areas, the seed of the best plants being distributed to the farmers for testing. The soil was a light volcanic loam of comparatively uniform composition.

ROW TRIALS. — Three new grasses were tested: *Pennisetum massaicum*, *P. tristachya*, and *Setaria nigrirostris* (South African Pigeon Grass). The first proved worthy of further trials. It stooled well, resisted several severe frosts in early winter, grew to a height of 2 ½ feet, but was eventually destroyed by a succession of very heavy frosts. The second, a native of Brazil, did badly. The third stooled well, grew strongly in autumn and reached a height of 5 ½ feet; it, however, gives a coarse fodder and is killed by frost.

Field trials. — As the row trials, these were started in 1913.

In 1913 were grown: —

*Eragrostis curvula*, var. *valida* (a Love grass) — *Andropogon intermedius* (Rare blue grass) — *Eragrostis leptostachya* (Paddock Love grass) — *Paspalum dilatatum* — *Chloris Gayana* (Rhodes grass) — *Anthistiria avenacea* (Tall Oat grass) — *Bromus inermis* (Awnless Brome grass) — *B. unioloides* (Prairie grass) — to which were added: in 1914; *Pollinia fulva* (Brown Top grass or Sugar grass); in 1915; three new strains of *Bromus inermis* — *Phalaris bulbosa* (Toowoomba Canary grass); in 1916: *Schedonorus Hookerianus* (Hookers Fescue) — *Festuca arundinacea* (Giant Fescue) — *Pennisetum purpureum* (Elephant grass or Napier's Fodder grass) — *Andropogon Sorghum* var. (Sudan grass); in 1917: *Deyeuxia coarctata*.

*Eragrostis curvula*. — Gives a coarse fodder unsuited to cattle in New South Wales; discarded.

*Andropogon intermedius*. — Growth good; height 3 ½ feet; yield 3 tons 18 cwt. per acre; gives the highest yield of succulent forage of any of the New South Wales native grasses. Its chief merits are: — drought resistance, succulence, palatableness to stock, free seeding.

*Eragrostis leptostachya*. — A native grass; reaches a height of 2 ft.; very hardy; seeds freely; bears heavy stocking, average yield, 2 ½ tons per acre.

*Paspalum dilatatum*. — Considering the wetness of the beginning of the season, this plant grew and produced excellently (height 5 ft., yield 6 tons, 2 cwt. 3 qrs. per acre); in dry seasons it hardly grows at all, and therefore, can not be recommended.

*Chloris Gayana*. — Average height 4 ft., yield of forage 5 tons 5 cwt. 2 qrs. per acre; growth fair in both dry and wet seasons, but not readily eaten by stock because of its sour taste.

*Anthistiria avenacea*. — Native; drought resistant; height 5 ft. 3 in.; yield of greenstuff 5 tons 1 cwt. per acre; not to be recommended on account of its coarseness and poor seeding capacities.

*Bromus inermis*. — Height 2 ½ ft.; yield of grass 3 tons 5 cwt. per acre; is not well adapted to the coast, but does well in the northern and central Tablelands, and in the irrigation area.

*Bromus unioloides*. — The plot sown in 1913 has always given excellent harvests; the variety, normally annual, has there become perennial. Merits: — resistance to frost, free seeding habit, palatableness. Chief defect: — inability to withstand heavy grazing.

*Pollinia fulva*. — Native; height 3 ft. (rare); yield of greenstuff 4 tons 2 cwt. per acre; tender, relished by stock.

*Phalaris bulbosa*. — Height 5 ½ feet; yield 7 ½ tons per acre; fodder tender, easy to harvest and thresh; excellent hay; grain has high percentage of germination; resistant to cold, but only slightly so to hot, dry summers; the best winter and spring grass tested at Hawkesbury.

*Schedonorus Hookerianus*. — Native; drought and frost resistant; adapted to high districts; grows little, fodder coarse.

*Festuca arundinacea*. — Grows little; fodder coarse.

*Deyeuscia coarctata*. — Promising; fodder tender.

*Pennisetum purpureum*. — Great growth and very high yield, height 10 to 11 feet with 60 to 80 stalks per stool, 21 tons per acre; does not set seed, but is easily propagated by cuttings or roots; dairy cows eat the whole plant when it is chaffed, but otherwise only the leaves.

*Andropogon sorghum*. — It gave two harvests during the year, yielding a total of 6 tons 10 cwt. 0 qr. 15 lb.; a plot grown for seed threshed at the rate of 623 ½ lb. per acre. It gives a higher yield than Hungarian millet (*Setaria italica*); resists summer drought; grows rapidly; is specially suited for a hay or soiling crop. Of all the grasses tested at Hawkesbury this is the best adapted to dry climates, and, under normal conditions, is superior to the others as a hay or soiling crop.

## FIBRE CROPS

297 — *Wrightia annamensis*, a Textile Fibre Plant of Indochina. — See No. 348 of this Review.

## HORTICULTURE

298 — **Strawberry Growing in the United States.** — DARROW, GEORGE, M. — I. Strawberry Culture in Tennessee, Kentucky and West Virginia. *U. S. Department of Agriculture, Farmer's Bulletin* 854, pp. 24, 11 figs., bibliography. Washington, August, 1917. — II. Everbearing Strawberries. *Ibid.* No. 901, pp. 19, 7 figs. Washington, November, 1917.

I. — Strawberries are very largely grown, both intensively and extensively, in Tennessee, Kentucky and West Virginia. Intensive methods are the best suited to the district. The author deals with the following points: — choice of farm; choice of field; preparation of soil; fertilisers (acid phosphate and steamed bone meal are most commonly used, being applied at the rate of 200 to 800 lbs. per acre; stable manure should only be applied to crops preceding strawberries); planting (at intervals of about 3 ft. in rows 3 ½ ft. apart; the distance between the plants should be reduced to 18 inches if there is any danger of the plants' being killed by insect larvae or drought; after hoeing, the ground is usually covered with straw while the plant is growing); methods of cultivation.

The Klondike variety is that most extensively grown in Tennessee. The Aroma is found especially in the north of this State; round Nashville, Gandy is preferred. In Kentucky, Aroma is considered the best variety, but in heavy clay soils Gandy is considered best. In other parts of Ken-

tucky and in West Virginia the chief varieties grown are Gandy, Aroma and Dunlap.

II. — Most of the European everbearing strawberries are descended by hybridisation from the Alpine strawberry. The American everbearing strawberries, however, are derived from a plant bearing flowers and fruit in all the stages of its development, found by Mr. SAMUEL COOPER in 1898 among plants of the Bismarck variety, considered to be a cross between the Van Deman and the Bubach varieties. Mr. COOPER named this plant Pan American, and from it he obtained other varieties bearing fruit till autumn; amongst these may be mentioned: — Autumn, Productive, Superb (the widest known and the best), Peerless, Onward, Forward and Advance. The value of the last four has not yet been determined, but Peerless seems to have characters superior to those of Superb.

Mr. HARLOW ROCKHILL of Iowa has obtained many everbearing plants by crossing the European variety, Louis Gautier, with the Pan American and other varieties which normally only bear fruit in early summer. The best known of the varieties thus obtained is Progressive (Dunlap × Pan American); mention may also be made of the varieties Iowa and Standpat (both derived from Pan American × Dunlap). Other varieties, the value of which has not yet been determined, have been obtained by different workers, especially at the Minnesota Agricultural Experiment Station.

The characters and adaptation to different parts of the United States are first examined, and the following points then discussed: — soil; time and method of planting; cultural methods; harvesting; yields. East of the Rocky Mountains the Superb variety is less productive than the Progressive, but, under favourable conditions, over 1000 quarts per acre may be obtained in summer and autumn. In the irrigated districts of Idaho, Oregon and Washington, where the conditions seem more favourable to this variety, the yields are higher. The early summer crop of Superb is generally larger, with bigger berries, than that of Progressive. The varieties of everbearing strawberries now on the market are: — Advance, Americus, Autumn, Forward, Francis, Iowa, Onward, Pan American, Peerless, Productive, Progressive, Standpat and Superb. The Superb and Progressive varieties are most widely grown. Another variety, obtained in 1910 — Minnesota No. 1017 — distributed by the Minnesota State Horticultural Society, has been introduced on to the market. It is very vigorous and very productive, with globular, dark red, firm berries of excellent quality. Although grown in Minnesota and the neighbouring States, this variety is not to be recommended at present for general planting because, in certain districts, it has been found to show but slight resistance to cryptogamic diseases.

299 — **Raspberry Culture.** — DARROW, GEORGE M., in the *U. S. Department of Agriculture, Farmer's Bulletin* 887, pp. 44, 33 figs. bibliography. Washington, October, 1917.

In the United States the raspberry is grown, not only in small plantations for the home and local market, but, in some districts, as the principal commercial crop. Statistics show that, in 1909, there were 48 668 acres of raspberries in the United States.

The methods of cultivation on estates which specialise in raspberries are very progressive. Detailed information is given on: — choice of plantation; preparation of the land; planting (there are 3 methods of planting — 1) the hill system, in which a horse cultivator is used on all sides of the plant; 2) linear; 3) hedges, where the cultivator is used in one direction only); manuring (an average of 10 tons per acre of stable manure, leguminous cover crops to be dug in as green manure); training and pruning; winter protection.

The yields vary greatly according to the variety grown, the methods used, and climatic conditions. In New York the average yield is from 1 300 to 1400 quarts of red raspberries per acre. In Colorado, the Marlboro' variety, if well protected during winter, will yield over 4 000 quarts per acre. In the Puyallup Valley (Washington), fields of Cuthberts properly cared for will yield 6 000 quarts per acre, and the Antwerp, 8 000 quarts per acre.

The best varieties now grown are: —

**RED AND YELLOW VARIETIES:** Antwerp, Cuthbert, Eaton (including the varieties Idaho and Iowa), Empire, Golden Queen, Herbert, Junc, King, London, Marlboro', Miller, Ohta, Perfection, Ranere (St. Regis variety), Ruby, Sunbeam, Superlative, Surprise, Welch.

**PURPLE VARIETIES:** Cardinal, Columbian, Haymaker, Royal (Royal Purple variety) Shaffer.

**BLACK VARIETIES:** Cumberland, Farmer (Plum Farmer variety), Gregg, Hoosier, Kansas, Ohio, Older, Pearl (Black Pearl).

A large part of the raspberry crop is marketed in the fresh state. The Census Bureau estimated the value of canned raspberries in 1914 to be \$1 137 207.

#### FRUIT GROWING

300 — **Citrus Cultivation in Surinam.** — LIEMS, J. A., in *Department van den Landbouw, Suriname, Bulletin* No. 35, pp. 29 + plates. Paramaribo, November, 1917.

There are many orange trees scattered about the plantations in Dutch Guiana, but orange groves have only been formed there more or less recently; the first, planted at Vredenburg, contained 142 trees. Near Surinam is a nine year old grove covering about  $4\frac{1}{2}$  acres, and another covering nearly 34 acres, composed of native citrus trees from 3 to 8 years old. Other groves have been planted near the Commewyne River. In order to increase the cultivation of citrus trees the Department of Agriculture of the Colony has recently distributed, amongst small holders, a large quantity of grafted orange trees. Of all tropical fruits the orange is the best adapted to export. Exportation was begun in 1907 and, since then, the local Department of Agriculture has shipped oranges and tangerines to Holland. From the point of view of the prices obtained the results were encouraging. In 1909, 0.24 d. was obtained per orange sold in Holland; in 1910,  $\frac{1}{2}$  d., in 1914, 0.36 d. In 1911, as a result of delay in the departure and voyage of the boat carrying them, the oranges arrived in an unsaleable condition. In 1912, as the crop was poor, no fruit was exported. The experiment was a complete failure in 1913 as a result of the unfavourable shipping conditions. As the boats were not suitably fitted for carrying oranges, a large number of damaged fruit was found in all the shipments to Holland. According to the author, there is no doubt that, when normal con-

ditions prevail again, the shipments may be re-started under conditions favourable to the keeping of the oranges during transport, so that a better price will be obtained for the fruit exported. In Surinam the oranges ripen from July to October, the months during which they are absent from the European market. As Surinam oranges are larger and of better flavour than European ones, they are much in demand on the Amsterdam and Dutch inland markets.

The rules to be observed in sowing seed, care of the seedlings in the nursery, grafting, final plantation (in squares, 25 feet apart, or about 70 trees per acre), cultural methods, etc. are given.

The chief disease is gummosis, found in groves where the trees are too close together. The chief injurious insects are ants, which greatly damage the orange trees, and scale insects, which attack particularly young nursery plants.

As the cultivation of orange trees is relatively recent in Surinam, it is too early to state which foreign varieties are to be recommended. Lambs Summer variety produces, in sandy soil, good fruit much appreciated in Europe, but which ripens a little late. The Washington Navel orange is less good and less juicy than the native fruit. The Director of the Botanical Garden and the author have sought the best varieties for propagation among the native varieties.

A yield of 1000 fruit per adult tree is not exceptional. At Vredenburg in 1911, a tree gave 3 800 fruit. The average yield per tree may be placed at 500 fruit. Estimating the sale price at  $\frac{1}{4}$  d. per orange, an acre of 65 trees with an average of 500 fruit would bring in about £ 40; from this must be subtracted the cost of cultivation, placed at about £ 4.

The methods of packing are described, those used in California for shipping oranges being specially recommended.

301 - The Nigerian Lime Tree (*Citrus medica* var *acida*). — See No. 254 of this Review.

302 - The Cultivation of the Pistachio Tree. — See No. 254 of this Review.

303 - Hybrid Bearers in 1917 in France. — PÉB-LABY, F., in *La Vie agricole et rurale*, Year VII, No. 32, pp. 103-106; No. 36, pp. 170-173. Paris, 1917.

VINE GROWING.

In view of the ever increasing damage caused by cryptogamic diseases in the vineyards, the use of hybrid bearers becomes essential, and it is advisable to plant them without hesitation. The principal hybrids, new and old, are described with special reference to their behaviour in 1917, especially in the author's experiment plot at Toulouse.

I. — BEHAVIOUR OF SOME OLD HYBRIDS. — Seibel Nos. 1020, 156, 128, 1077. The attack of black rot which occurred during the first days of June had no serious effect on these four hybrids. There were a few patches on the leaves, and very little on the pedicel of the bunch. None of them spread on account of the prolonged drought and heat. Some French plants, such as *Portugais bleu* and *Grand noir* suffered rather badly in Bas-Languedoc; in Armagnac some districts were seriously affected by this disease. Only in

some badly exposed rows were blisters causing loss of grapes on the bunches of 1020, 128 and 156. These three hybrids gave excellent crops.

Mention must be made of 128 on account of its remarkable behaviour in 1917, with goodsized fruit. The plants, which had been attacked by black rust two years before, and had given no harvest since then, gave a particularly heavy crop without any treatment whatever. The two stocks which suit it best are 3306 and *Rupestris du Lot*. In the experiment plots at Toulouse it does as well direct as grafted.

As usual 1020 yielded well, perhaps better ungrafted than grafted. Except a few badly exposed plants which suffered from mildew and oidium, they were all healthy with yields which varied according to the stock. In 1917, the stocks which appeared to suit it best were 34-E and 3306.

There is nothing of particular interest to be noted for 1077, which behaved as usual. It must be noted that this hybrid, known to be sensitive to black rot, showed no patches on the clusters as the others did. This is probably because it was grown in a more airy, sunny place with a better exposure.

These four hybrids have never been treated with sulphate or sulphur during the ten years since they have been planted. There is no doubt that, had they been treated with copper or sulphur, they would not have suffered from the attacks mentioned, or only to a very slight extent.

*Seibel 138*: — An excellent plant, either direct or grafted. The lace-like patches of mildew on its leaves never attack the grapes and do not prevent them from ripening; if it does not yield heavily it at least yields regularly.

*Seibel 1003*: — has never failed to give a crop of medium sized grapes; it suffers more from lime than from mildew.

*Seibel 2*: — always gives a regular and good yield; suffers very little from mildew; does well with *Riparia* as stock.

*Seibel 1000*: — did very well as in the preceding years, but lost part of its fruit as a result of black rust; the harvest was reduced by half; neither the soil nor the climate of the Toulouse Garden suit it; but it does very well elsewhere, especially in the south.

*Seibel 1070*: — does very well in good exposures; always has a heavy crop; suffers from oidium, but one or two good sulphurings protect it.

*Couderc 7103*: — has the same fault and needs the same treatment; gives a fairly good yield; not too sensitive to mildew.

*Couderc 7104*: — showed its usual good and bad qualities; lacks vigour when ungrafted and with most stock; it gives a small harvest but excellent grapes.

*Couderc 7120*: — always the same, suffers from no disease and gives an average, but regular, harvest; produces better in the south than in the south-west.

*Couderc 4401*: — its principal fault is that it suffers from oidium and black rust; in the author's garden, part of the crop is lost each year as a result of this last disease; elsewhere, if well tended, it produces well and without non-setting.

*General 157*: — ~~white~~, is placed among the old hybrids because, in spite

of its faults, it is found everywhere at the present time; it is fairly liable to mildew and not resistant to oidium; in 1917, as in preceding years, the leaves which had not been sprayed with sulphate were attacked, but there was neither grey rot nor red rot on the clusters; it is in demand everywhere because if treated with sulphate and sulphur its heavy yield (about 9 to 13 lbs.) is assured.

It is seen that among these old hybrids are some good ones, which, in the absence of others, might be used, for 128, if well exposed, 156, and Nos. 2, 138, 2003, 1070 and 7120 always give relatively good yields, especially if treated once or twice with copper and sulphur. *Girerd* and 1020 are now appreciated everywhere. There are, however, more recent hybrids which are justly considered superior to the preceding ones by reason of better grapes, a greater resistance, and absence of certain faults, recognised by those who grow them or make wine with them.

II. MORE RECENT HYBRIDS. — A. BLACK HYBRIDS. — (Untreated with copper and sulphur)

*Seibel* 753 : — has just a few small unimportant spots of mildew on its leaves, the grapes are intact, of good size, well-spaced; very regular.

*Seibel* 873 : — resists mildew well, did not suffer in 1917 either on the leaves or fruit, which is large, close and almost average.

*Seibel* 4121 : — remarkable for the resistance of its leaves and its clusters; the author has never seen the slightest sign of disease on it; bears a good crop, and, although its fruit is not very large it gives 13 lbs. or more per plant; neutral wine, strongly coloured, giving, in 1916, 9.6°; strong plant, doing as well ungrafted as grafted; bushy.

*Seibel* 4643 : — only has a few negligible spots of mildew on its leaves; grapes intact, fairly long, not very close, excellent, sweet, giving a first class wine; rather similar to French plants.

*Gaillard* 194 : — completely immune to mildew in the Toulouse Garden; elsewhere it is said to suffer slightly from this disease; in the Toulouse garden it is more vigorous direct than grafted, and to such an extent that the grapes did not all set; must be carefully pruned to avoid loss of the many grapes; ripens early; wine much appreciated.

*Jurie* 580 : — has the appearance of a stock plant with hardy leaves; barely subject to mildew; gives a heavy yield in good soils; very strong, does as well grafted as ungrafted.

*Malègue* 829-6 and 1551-2; liable to black rust which excludes them from certain damp districts; it may be protected from mildew by one or two sulphate sprayings; the second is rather later than the first; very good wine.

In this group of black grapes, *Seibel* 4121 and *Jurie* 580, are noted as particularly hardy; the two *Malègue* mentioned, as finer and almost equally good yielders.

B. PINK HYBRID : — *Seibel* 2859 *rose*; resistant to mildew without sulphate spraying; good yielder; good wine.

C. WHITE HYBRIDS. — This group includes plants valuable both for their resistance to disease and their produce.

*Seibel* 793 : — highly recommended on account of its great resistance

to all diseases ; if the grapes and seed are not very large, there is at least the certainty of an annual harvest, without non-setting, of good flavour, without the expense of copper or sulphur.

*Seibel 850* : — less resistant than the preceding one, but can do without sulphate treatment in years such as 1917; resisted well in the author's experiment plot ; fruitful ; average clusters with average grapes.

*Seibel 880* : — can, if necessary, do without sulphate spraying ; good and regular yielder, giving excellent grapes, but often below the average ; appears to be derived from 2 red parents — 28-112 and 2003.

*Seibel 867* : — fine, cylindrical cluster, winged, fruit above the average, does not suffer from non-setting or other defects ; may be said to be immune to all diseases ; wine said to be slightly foxy, which is not surprising as the plant is descended from 2003 and *Noah*, but is much less foxy than wine from *Noah*.

*Seibel 2653* : — valuable as a table grape in the absence of *Chasselas*, so long as it does not abort too much ; its chief fault in some years is liability to non-setting in certain districts ; not so subject to mildew as *Chasselas* and is satisfactorily protected against strong attacks by two or three sulphate sprayings ; fruit big, oval, and excellent, not subject to oidium.

*Seibel 4773* : — like 793 it is immune to all diseases, but gives a higher yield ; its wood and veins are also red, especially when growth begins, longer fruit rather wider apart ; very sweet juice.

*Seibel 3021* : — very slightly subject to mildew ; without ever having been treated with sulphate it lost no leaf through this disease ; grapes only average, or below the average, close-set and of good flavour, ripen in the second late period.

*Seibel 4681* : — has still better foliage ; cannot do without copper and sulphur ; yield below the average because fruit is below the average ; wine of good flavour and alcoholic.

With the exception of No. 2653, which requires two or three sulphate sprayings, all the other white hybrids can do without sulphate. If they do not give a high yield of 22 lbs. per plant they give a regular average yield of good-flavoured grapes, except 867 which is slightly foxy, and a wine rich in alcohol which may be used either alone or mixed, and is of great value for blending wines.

*Couderc 235-120* and 272-60 ; the first yields well and is easily protected ; the second is subject to oidium.

*Malègue 1157-1* and 1897-12 ; do well in the Toulouse district with an average of two sulphate sprayings ; a fairly large quantity of grapes above the average, ripening in the second late period, excellent wine ; the first is slightly subject to mildew.

III. NEW HYBRIDS. — These hybrids have been grown *directly* in the experiment garden since 1914 ; they are at their third leaf. They have also been grafted on various stock, and put in next to the direct plants the following year. None have been treated with copper or sulphur ; the square on which they are grown is about 9 yards from a *Chasselas* vine which was sprayed four times and eaten up by mildew. Round the edge of the plot



are hybrids which lost almost their whole harvest through mildew, black rot and oidium. Although the hybrids of this collection are not entirely immune to disease, they suffer less than the older ones. Their relative resistance may be seen at a glance and an ascending or descending scale easily constructed. For the vine-grower their value lies in the comparisons which may be made between the relative quality of about 60 hybrids grown side by side under identical cultural conditions and without any treatment.

The most important are :

*A. WHITE HYBRIDS* : — *Seibel* 4657, direct ; large leaf, wide, with shallow lateral sinuses ; large widely-spaced, very pointed teeth at edges, more marked than those of the muscatel, dark green, dull ; internodes from 13. to 15 cm., green, not red ; bunches large, branchy, loose, with oval fruit above the average, fairly far apart, ripening at the end of the first period, of good flavour and very sweet ; may be regarded as a table and vat grape ; very fruitful ; does not appear to be subject to non-setting, and is, consequently, a good yielder ; with neither sulphur nor sulphate treatment it only had a few insignificant spots of mildew on some of its leaves.

*Seibel* 4986 : — direct ; very vigorous ; leaves with deep sinuses and rounded at the base, very large, very pointed shiny teeth, set far apart ; long internodes of 17 to 20 cm ; bunches, mostly winged, cylindrical-conical, with round, fairly close fruit, average or above the average, ripening at the end of the first period ; good flavour ; very productive, does not non-set, thus giving a good yield ; very resistant to mildew and oidium.

*Seibel* 4633 : — direct ; best yielder of the whole collection ; excellent leaf of an almost dark green, shining as if varnished ; lateral sinuses absent, those preceding the tip, fairly marked, giving the leaf a round appearance ; teeth fairly wide and regular, internodes 9 to 10 cm. long, of green, thick wood ; very fruitful ; bunches above the average with round fruit, above the average, close, ripening in the second period, good flavour, almost perfect resistance, subject to neither mildew, oidium, nor black rust.

*Seibel* 4603 : — direct ; the lower leaves are dark green and cut out like those of a fig tree, the sinuses being shallow but the teeth round them well marked ; internodes 9 to 10 cm. long of green wood ; clusters cylindrical or fairly conical, with round, average, close fruit of good flavour ; very resistant to mildew.

*Seibel* 4955 : — direct ; leaves have hardly any sinuses and appear round, of the green of *Rupestris* and of average size ; internodes relatively short of 7 to 8 cm ; wood green ; very fruitful ; bunches cylindrical, usually above the average, with fairly close, round, average fruit ; a very few patches of mildew on the leaves.

*Seibel* 5279 : — direct ; leaf appears round and is only pointed at the base, where there are two shallow sinuses ; teeth few but fairly pointed ; tissue, slightly leathery as that of the Noah leaf ; internodes from 6 to 9 cm. ; wood green ; very fruitful ; clusters average, rather long, wide at the base, above the average ; fruit close, round, average, ripens early, end of August, grape sweet, excellent, remains a long time on the bunch and is a good keeping grape ; strong resistance to oidium and mildew.

*Seibel 4709* : — direct ; leaves long with normal sinuses, slightly pointed teeth, of a dark green colour ; internodes fairly large, from 8 to 10 cm., wood green ; very productive, clusters average, not very long, squat ; grapes average or above the average, round, close, of excellent flavour ; ripening during the first period ; very resistant to disease, barely a few spots of mildew in autumn.

B. RED HYBRIDS. — *Seibel 4015* : — direct ; leaves large and heart-shaped, without pronounced lower sinuses, teeth fairly prominent ; wood of shoots green ; internodes from 12 to 14 cm. ; very fruitful and, on account of its average clusters with average, round fruit, very productive ; ripens during the second period ; foxy flavour, which is its only fault ; remarkable resistance to disease.

*Seibel 4565* : — direct ; leaf large, wider than it is high, round, no sinus, large teeth ; seems fairly hardy ; wood green ; internodes average from 8 to 9 cm. ; very fruitful and productive ; cluster conical, long, above average ; fruit average, fairly close, round, ripening during the first period, slightly pulpy ; fairly good resistance to disease.

*Seibel 5145* : — direct, average leaf, round, with appearance and red veins of the Berlandieri leaf, without well-marked teeth ; wood red ; internodes fairly long, 10 to 12 cm. ; good producer ; clusters above the average, long and sometimes winged, fruit average, round, juicy, ripening during the second period ; excellent resistance to disease.

## LIVE STOCK AND BREEDING.

### HYGIENE

304 - **Screw-Worms and other Maggots Affecting Animals.** — BISHOP, F. C., MITCHELL, J. D. and PARMAN, D. C., in *U. S. Department of Agriculture, Farmers' Bulletin* 857, pp. 20, 8 figs. Washington, September, 1917.

The screw-worm (*Chrysomya macellaria* Fabricius) is a native of America, and is found from the extreme south to Canada, but is rarely abundant in the Northern States, as the fly is quickly killed in cold weather. The states of North America which suffer most severely are Texas, Oklahoma, New Mexico, Arizona and Southern California.

Practically all animals are attacked by this insect. Probably cattle suffer most ; hogs, horses, mules, sheep, goats and dogs follow in the order named. Wild deer (*Cariacus* sp.) and many of the smaller mammals are sometimes seriously infested. Human beings are also frequently attacked. The female lays its eggs in wounds or skin injuries, where the parasite remains throughout the larval stage. The pupa is usually found in the ground. A huge number of eggs may be deposited in a mass by a number of females. In livestock the parasite always causes loss of appetite and emaciation, and sometimes death. In some districts it makes calf-rearing almost impossible (the fly lays its eggs in the navel of the new-born calf, often causing its death) and older cattle have to be bought elsewhere. In sheep it causes emaciation and decreased milk production, and in all cases involves increased expenses for the watching and treatment of animals.

The screw-worm fly is the only species in the south-west of the United States which penetrates the sound tissues of animals, but other flies attack the diseased tissues of wounds and soiled wool. These flies are: — the black blowfly (*Phormia regina* Meigen), green bottle fly (*Lucilia sericata* Meigen), and gray flesh flies (*Sarcophaga texana* Aldrich, *S. tuberosa* var. *sarracenioides* Aldrich, *S. robusta* Aldrich). All these flies breed in decaying animal matter, especially in carcasses of large animals. If all dead animals were properly disposed of no cases of infection of living animals would occur.

The best method of control is the burning of carcasses. This reduces the danger of infection by anthrax, tuberculosis and similar diseases in the pastures and prevents the breeding of flies in the carcasses. If it is not possible to burn the carcasses they should be buried, covered with quicklime (especially if the death of the animal may be attributed to an infectious disease) and then covered with at least 2 feet of soil.

Methods of controlling the parasite in cattle are: — avoidance of injury, calving at a time when the flies are not abundant (between December 1 and the middle of April, and, in the north, from November 1 to June 1), destruction of ticks, performance of surgical operations (castration, dehorning, etc.) in winter or the beginning of spring, poisoning and trapping the flies. To prevent the larvae from infesting the wool of sheep, lamb early and dip and clip soiled sheep. To avoid dehorning, hornless types may be bred. The animals must be continually watched so as to discover the first symptoms of infection, and the larvae killed with chloroform, the wounds being then treated with pine tar to repel the flies.

Appended is a list of 33 publications issued by the United States Department of Agriculture on insects affecting the health of man and domestic animals.

305 — **The Cause and Prevention of Hairless Pigs, in the United States.** — WELCH, HOWARD, in *Montana Agricultural College Experiment Station, Circular 71*, pp. 37-47, 9 fig. Bozeman, Montana, 1917.

It has been known for some years that, in certain of the Northwestern States, the new-born of all the domestic animals were in some way defective. New-born pigs were hairless and seldom lived; the calves were often hairless and more frequently had goitre. The young of sheep and goats were similarly affected, while new-born foals, though neither hairless nor having goitre, were weak, seldom able to stand and usually died.

In Montana, the loss is probably heaviest in young pigs, for about 10 000 are estimated as dying from this cause annually. In some localities pigs are the only domestic animals affected, while in others, it may be lambs only. It is a disease of definite localities, occurring in Montana in the drainage basin of the Yellowstone, the lower Missouri, the Musselshell and some of the smaller tributaries; outside this zone, a number of scattered cases constitute about 5 % of the total loss. In some cases, the pig crop can be saved on moving the pregnant sows a mile or two out of the affected district during gestation. The malady varies curiously: one year it may cause 95 % loss, and nothing the year after. There are also variations in a sin-

gle pen of pregnant sows. Pigs born in March and April are more often affected than those born in May and June, while autumn-born pigs are frequently normal even in badly affected districts.

Amongst causes of the trouble have been suggested: — contagious abortion; alkali in the soil; some particular feed, such as alfalfa, flax, maize, or wheat; or some deficiency in the soil or water. All these causes have been studied by the author, but negative results were always obtained.

Post-mortem examinations showed: — that the hairless pig has a thick, pulpy skin, especially round the head, neck and shoulders; that the thyroid gland was very hypertrophied and the heart not fully developed. The development of goitre and the hairless condition are of related gravity. This led the author to suppose that goitre was the cause of the disease, and he found, by analogy with human goitre, that the hypertrophied thyroid glands contained much less iodine than the normal quantity, or even none. He therefore concluded that the cause of the malady is lack of iodine in the food and water given to the animals, and that it was worth testing whether this insufficiency could be compensated for by giving potassium iodide. Tests made with pigs (with 129.5 to 324 mgm. of potassium iodide per head per day), with female breeding stock during gestation, gave positive results. Iodide of potassium given to a pregnant female prevents goitre appearing in the newborn. Therefore, it is advisable to feed iodine to pregnant animals in regions where goitre is prevalent.

306 — **Iron as an Antidote to Cottonseed Meal Injury** (1). — WITHERS, W. A. and CARRUTH, FRANK, F., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 2, pp. 245-257, 4 diagrams. Baltimore, November, 1917.

Experiments carried out at the Chemical Division of the North Carolina Agricultural Experiment Station, West Raleigh, showed that, though rabbits are very sensitive to poisoning by cottonseed meal (obtained by extraction of the oil by solvents) even when it has been cooked a long time, they could be successfully fed with this meal for a long period (the experiment lasted 106 days) if it were mixed with ferric ammonium citrate. The authors extended these experiments, using pigs as subjects, in order to investigate whether the harmful action of cotton seed meal is due to an injurious substance or, as some assert, to inadequate or badly proportioned diet.

Although the addition of iron salts is not to be recommended as a practical method for overcoming cottonseed meal poisoning, the experiments show that, when such salts are present, much larger quantities of the meal may be fed, with a resulting increase in body weight; in some cases it was even possible to prevent death, in many, to retard it. Further evidence of the presence of a toxic substance in the meal is the fact that extraction with alcoholic alkali removes the toxicity (experiments with rabbits). The authors assume the loss of toxicity to be due to: — 1) the formation of an insoluble iron salt of gossypol or one of its derivatives; 2) the catalytic

(1) See also *R.* January, 1918, No. 64. (*Ed.*)

acceleration of the oxidation of gossypol; 3) perhaps a tonic action of iron.

When cottonseed meal is treated with iron salts it turns brownish black, proving that a reaction takes place with some component of the meal. The action of iron salts on a solution of gossypol produces a similar colour. The fact that the effects of the toxic factor may be inhibited by the action of iron salts shows that the toxicity of cottonseed meal is not due to a lack of "vitamines" or to a deficiency in calcium, sodium and chlorine, as might be expected from the chemical analysis of a diet of maize and cottonseed meal.

It is interesting to note that, in the authors' experiments, wood ashes had no antidotal action in preventing the death of pigs fed on maize and cottonseed meal, but the animal receiving ashes made much better gains, probably because of the improvement in the inorganic part of the diet. The appended table gives the results of one of the four experiments. In each of the four experimental groups were 9 pigs fed with a mixture of 25 % cottonseed meal, and 75 % maize meal. To each 4 lbs. of feed the control group (to which no iron salts were given) received 1 gallon of water, group 2, 1 gallon of copperas solution (1 lb.  $\text{Fe SO}_4 \cdot 7\text{H}_2\text{O}$  dissolved in 50 gallons of water), group 3, 1 gallon of ferric chloride, containing approximately the same amount of iron as the preceding solution; group 4, 1 gallon of water with hardwood ashes *ad lib*. The experiment lasted 94 days.

*Effect of the addition of iron to a diet composed of 25 % cottonseed meal and 75 % maize meal.*

Group	Feed	Weight (in lbs.)				Deaths (among 9 animals)
		Initial	Final	Daily gain	Cottonseed meal eaten	
1	Control . . . . .	103.4	107	0.05	47	6
2	Copperas . . . . .	92.1	134.6	0.46	66	3
3	Ferric chloride . . . . .	102.2	163.2	0.68	80	1
4	Hardwood ashes . . . . .	98.3	137.7	0.67	50	7

307 - **The Poisonous Properties of the Two-Grooved Milk Vetch (*Astragalus bisulcatus*).** — BEATH, O. A. and LEHNERT, E. H., in the *University of Wyoming, Agricultural Experiment Station, Laramie, Wyoming, Bulletin No. 112*, pp. 58-67, 1 fig. Laramie, January, 1917.

As *Astragalus bisulcatus* is not mentioned as a poisonous plant, the above bulletin gives an account of it to warn stockmen of its poisonous nature. It grows in plains and valleys in the Rocky Mountain region. Milk vetch is possibly most dangerous when fully mature but, when dry (as hay), it seems more or less harmless. Experiments carried out at the Wyoming Agricultural Station have lead to the conclusions given below.

Milk vetch is certainly poisonous to cattle; its effect upon sheep is

uncertain ; 80 to 90 % of the animals affected die. Water easily removes the active poison from green or air-dried material. All parts of the plant contain poison, with a slight excess in the leaves. The poison is neither precipitated by basic acetate of lead nor decomposed at 100° C. ; it loses its toxicity on boiling with dilute acids, indicating its probable glucosidic character, as does the fact that a crystalline substance has been isolated giving reactions of glucosides ; at any rate, it is non-alkaloidal.

Thus far no chemical antidote has been found. When sufficient poison to cause death is introduced into the system, whether through the stomach or intravenously, it is quickly absorbed and soon produces symptoms of paralysis, by its action on the nervous system ; the action of the heart is also interfered with, and the poison no doubt kills by acting on this organ ; therefore drugs that stimulate the heart and the nervous system (alcohol, aromatic spirits of ammonia, belladonna extract, tincture of digitalis) should prove beneficial ; these remedies should be preceded by a drench of 1 to 2 lbs. of Epsom salts.

308 - **Experiments on the Reported Poisonousness of Wild Melon Fruit.** — DODD, SYDNEY, in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 2., pp. 815-819. Sydney, November 2, 1917.

Many Australian stock-owners believe the fruit of the wild or "paddy" melon (*Cucumis myriocarpus*) to be poisonous to livestock, causing injury to the nerves and blindness. The green part is also said to be harmful, but because it is indigestible rather than poisonous. In South Africa this fruit has been reported as poisonous to sheep and, in one case, as having caused the death of a child. Both in Australia and South Africa several feeding experiments have been made in which the wild melon was fed to animals, but contradictory and inconclusive results were obtained, because the fruit was eaten for a short time only, and as the disease it causes is chronic, it results only after it has been fed for a prolonged period. The ripeness of the fruit must also be taken into consideration, as some stock-owners assert that it is injurious only before it is ripe. In some districts the drovers gather the fruit to give to their horses.

The author carried out two series of experiments in which wild melon fruit was fed to three guinea-pigs, two rabbits, a sheep and a horse. Two of the guinea-pigs, fed on unripe fruit, died, the other guinea-pig and the rabbits, after eating the fruit for about a month remained healthy and normal. The sheep was forcibly fed with the fruit for 20 days without showing any sign of poisoning ; on the 21st. day it was asphyxiated through the carelessness of the attendant. The horse was fed for 51 days with wild melon mashed up with bran, in amounts of about 2 lbs. 2 oz. per day, then of about 4 1/4 lbs. per day. It showed no sign of disease.

It seems as if the ripe fruit of wild melon may be considered harmless, but the author does not consider his results conclusive and intends to continue the investigations.

309 — **Pyotherapy in the Treatment of Harness Wounds ; Some Considerations on the Efficacy and Absolute Non-Specificity of Anticryptococcal Pyotherapy on the Horse.** — VELU H., in the *Bulletin de la Société de Pathologie exotique*, I, Vol. X, No. 10, pp. 901-903. Paris, December, 1917. — II. Vol. XI, No 1, pp. 12-17. Paris, January, 1918.

I. — In the course of recherches on the pyotherapy of epizootic lymphangitis (1) the author has repeatedly found how efficacious is treatment with polyvalent vaccines (either anticryptococcal vaccine, or vaccine prepared from ordinary suppurations) for curing *non-specific* lesions, caused by harness.

During the negative phases, the peripheral inflammatory reaction becomes intense ; the separation furrow forms more quickly ; the necrosis tissue is eliminated more easily, on account of the increased suppuration ; surgical intervention becomes more easy, and the wound clears up without useless decay. During the positive phases, the wound cicatrises almost without suppuration, with surprising regularity and quickness. Local antiseptic treatment becomes almost accessory.

The author states that he has, by means of pyotherapy, rapidly cured arthritis and a severe traumatic synovitis, as well as obstinate bony fistulae. LIGNIÈRES (Bacteriotherapy in the treatment of Wounds, *Bulletin de la Société Centrale de Médecine Veterinaire*, 1915, pp. 544-548) has already pointed out that specific organisms are not the only ones that give good results when injected into sick subjects. An antianthrax vaccination may stay the spread in a herd of a disease in no way connected with anthrax ; wounds that wont heal may do so after injection of an organism unconnected with the disease, such as *B. coli*. On the other hand it is well known that the injection of any antigen is followed by a hyperleucocytosis.

In conclusion, pyovaccine provides a very efficacious, simple and economic method within the reach of all practitioners, for reducing, in considerable proportions, the time lost in laying-up for harness wounds.

II. — The polyvalent anticryptococcal pyovaccine prepared at the Casablanca Laboratory has been used for treating pyogenous lesions of the horse due to pathogenic agents other than the cryptococcus. The results clearly showed the definite action of the pyovaccine.

In every case, the injections brought about decreased local inflammation, less pain, the diminution, then disappearance, of suppuration, and in certain cases, sterilisation of the lesions. Their non-specific effect is undoubted, even when they do not bring about complete recovery.

The author quotes work of other experimenters on other vaccines, showing their non-specific action, and he concludes, speaking generally, that polyvalent, paraspecific pyotherapy is a very simple and economical method which, whether by results already obtained, or those rightly expected, should take a prominent place in the practice of veterinary therapeutics.

(1) See R., July 1917, No. 611 ; R., August 1917, No. 734 ; R., February 1918, No. 176 ; and No. 310 of this Review (Ed.)

310 — **The Curative Treatment of Epizootic Lymphangitis by Vaccinotherapy; Preparation of a Polyvalent Pyovaccine.** — I. VELU, H., in the *Recueil de Médecine Vétérinaire publié à l'Ecole d'Alfort*, Vol. XCII, No. 9 and 10, pp. 195–204. Paris, 1917. — II. IDEM, in the *Bulletin de la Société de Pathologie Exotique*, Vol. X, No. 8, pp. 681–684. Paris, 1917. — III. IDEM, in *Ibid*, Vol. XI, No. 1, pp. 10–11. Paris, 1918.

Work carried out at the Research Laboratory of the "Service de l'Élevage du Maroc" at Casablanca..

I. — The vaccine is obtained from pus from diseased horses and is, thus, an "anticyptococcal pyovaccine". The subcutaneous injection causes, more or less rapidly, a reaction of the organism shown by very clear clinical signs at the level of the specific lesions. First appears a *negative phase* (aggravation of all the symptoms), which is then replaced by a *positive phase*.

The question of treatment consists in finding out suitable doses, and the frequency of renewal, so as to cause insignificant negative phases and predomination of positive ones.

The author gives results obtained with sick horses, and describes the broad lines of his method, which has given excellent results.

II. — After new clinical observations on over 100 animals for over 6 months, the author, having slightly modified his method, gives the final technique as follows: —

1) Injections of pyovaccine cause a reaction with effects localised at the level of the lesions. There is a negative phase. Therefore, all lesions containing pus should be punctured from the start.

2) Subcutaneous injections of pyovaccine sometimes cause abscesses that heal slowly; for this reason, intravenous injections are advised, as giving quicker and more certain results.

3) The first 2 injections of pyovaccine, and especially the second, in strong doses (4 to 6 cc. for the first, 1.5 to 2.5 cc. for the second), produce intense and lasting positive phases. The doses should, in consequence, be strong and separated by intervals of 8, 10 or even 12 days. The giving of another injection should be delayed until the moment when the positive phase begins to slacken, that is, when the improvement begins to decrease, but one should not wait longer than this.

4) After the second injection the organism is very sensitive. So, after the third injection, small doses of pyovaccine (0.75 to 1.25 cc.) must be given. Fresh injections should be given immediately the positive phase begins to weaken, i. e., about every 5, 6, 7 or 8 days.

The author states that the effects of pyovaccination are not strictly specific, and that he has obtained, with anticyptococcal vaccine, excellent results in the treatment of obstinate fistulae or of considerable lesions that did not show the causal organism of epizootic lymphangitis.

III. — *Polyvalent* vaccines and serums are those that act against several species of organisms, and *polyethmic* vaccines and serums are those that act against several varieties of the same species. Under these conditions, pyovaccine prepared with products obtained from several horses suffering from epizootic lymphangitis, is a polyethmic anticyptococcal pyovaccine, for it solely contains cryptococci of different strains. In the open lesions of



the disease there are, besides the cryptococcus in abundance, numerous and abundant associations of bacteria that certainly play no unimportant part; a polyvalent pyovaccine can thus be prepared which will act both on cryptococci and associated organisms.

The technique for preparing the vaccine is as follows: Remove the pus from closed lesions by means of a sterilised syringe, after cutting the hair and disinfecting the skin over the abscess; also remove with the syringe the pus or serosity collected at the surface of open lesions, under the crusts covering them; read off the volume on the graduated syringe and empty into a sterilised flask containing a known quantity of ether and phenolated physiological serum at 5 ‰; mix well by shaking; mix together the pus obtained from several cases; add the quantities of ether and 5 ‰ phenolated physiological serum required to bring the vaccine to the ratio of 1 of pus to 1.5 of ether and 10 of phenolated physiological serum; filter through 4 to 6 sheets of sterile gauze.

The vaccine thus obtained will be a polyvalent antipyogenous vaccine for treating, not only epizootic lymphangitis, but also various pyogenous lesions of the horse.

311 - **Pyotherapy in Epizootic Lymphangitis; Researches in Italy.** — IANFRANCHI, A. and BARDELLI, P., in *Il Moderno Zoonatro*, Series V, Year VI, No. 12, pp. 261-275, diagrams 7. Bologna, December 31, 1917.

After summarising the work carried out by MANGAN, BELIN and VELU (1) on pyotherapy, the authors give a detailed description of their treatment of epizootic lymphangitis by means of pyotherapy, which has given completely negative results. "In all the animals treated, whether the lesions were slight, of moderate severity, or severe, the 2 series of 6 injections (each of 2 cc. of pyovaccine) with an interval of 8 days, caused no diminution of the progress of the disease"; even with subjects used as controls, during the experiment, it was found that the injections of pyovaccine "have accelerated and aggravated the disease". Therefore, according to the authors, at the present state of our knowledge, autotherapy and pyotherapy are not methods of treatment the use of which could be advised in epizootic lymphangitis.

312 - **The Vitality of the Rinderpest Virus Outside the Animal Body under Natural Conditions.** — SHILSTON, A. W., in the *Memoirs of the Department of Agriculture in India*, Veterinary Series, Vol. III, No 1, pp. 32 + IV plates. Calcutta, October, 1917.

Great uncertainty has existed in regard to the length of time that rinderpest can exist outside the animal body, either under natural conditions or when special measures are taken to preserve its vitality. On this account, the experiments described in the present Memoir, were designed to ascertain the duration of the vitality of the rinderpest virus 1) on ground in the open air, 2) in closed sheds, 3) in faeces, urine and mucous discharges, and 4) in meat, blood and bones under varying natural conditions. To make the

(1) See also R., 1917, No 734; R., February 1918, No 177 and 178. (Ed.)

covering a distance of 3.9 to 4.8 km. per hour, did this work with an expenditure of energy equal to 0.580 kilogrammeter (to move 1 kgm. 1 meter). Although the weight of the dog varied 17 % during the experiments, and the speed of the treadmill 20 %, the maximum difference in energy expended was 1.7 %. (It will be seen that there is a relation between the weight of the animal and the energy required to move its body horizontally; a 15 % gain in weight caused a corresponding gain of 15 % in the energy requirement).

TABLE I. — *Influence of mechanical work.*

	Date (1917)	Food gm.	Experi- ment No.	Weight of dog	Indirect calori- metry (cal.)	Respi- ratory quotient	Work in meters trav- elled	Calories above the basal per 1000 meters travelled	Kilogram- meters required
<i>8 hours after ingestion of standard diet.</i>									
A	January 5	—	2	8	60.8	0.78	3 925	11.0	0.585
	Feb. 28	—	8	9	70.0	0.81	4 300	12.3	0.580
	March 13	—	18	8.9	74.8	0.75	4 688	12.2	0.585
	" 23	—	24	9.2	76.7	0.74	4 717	12.6	0.582
	" 27	—	27	9.4	76.7	0.81	4 718	12.6	0.570
			13	9.0	76.1	0.79	4 806	12.2	0.578
									0.580
<i>During the hours immediately following ingestion of glucose.</i>									
B	January 5	Glucose, 70	3	8.35	62.3	0.98	3 936	11.1	0.579
	March 15	Glucose, 70	19	9.6	77.1	0.92	4 771	12.5	0.555
	" 26	Glucose, 100	26	9.7	76.8	0.95	4 737	12.5	0.550
									0.550
<i>4 or 5 hours after ingestion of meat.</i>									
C	January 11	Meat, 700 gm.	6	9.25	82.1	0.82	4 101	15.8	0.724
	March 6	No food.	13	9.0	76.1	0.79	4 806	12.2	0.578
	" 12	Meat, 750 gm.	17	9.6	92.4	0.80	4 704	16.0	0.708
	" 10	Meat, 750 gm.	16	9.5	* 30.6	0.80	—	—	—

\* Dog resting.

INFLUENCE OF MECHANICAL WORK DURING THE HOURS IMMEDIATELY FOLLOWING THE INGESTION OF GLUCOSE. — The same dog after the ingestion of 70 or 100 gm. of glucose in water did the same amount of work with an energy expenditure of 0.550 kilogrammeters (see Table I B.) Thus, to supply the same amount of mechanical work, the dog, immediately after the ingestion of glucose, requires about the same amount of energy (slightly

less) than when it does the work 18 hours after ingestion of the standard diet. It may, however, be said that, in spite of the addition to the weight of the dog of the aqueous solution ingested which increased the total weight to be displaced, the expenditure of energy was only 0.550 kilogrammeters; this figure, compared with the preceding one (0.580 kilogrammeters), shows that the ingestion of carbohydrates diminishes the energy required for a given piece of work by 5 %.

**INFLUENCE OF MECHANICAL WORK 4 OR 5 HOURS AFTER THE INGESTION OF MEAT.** — The results obtained after the ingestion of meat (see Table I C.) are in perfect agreement with those found by RUBNER in his experiments on man referred to above. The dog, 4 or 5 hours after the ingestion of meat, accomplished the work with an expenditure of energy exceeding the basal metabolism; this energy results from the sum of the specific dynamic action (1) of meat + the energy necessary for the work, the total being equal to an average of 0.587 kilogrammeters.

The ingestion of alanine (20 gm.) gives similar results, *i. e.* an energy expenditure resulting from the specific dynamic action of the substance and the work supplied.

TABLE II. — *Influence of mechanical work upon metabolism in fasting.*

Date '(1917)	Experi- ment No.	Weight (kg.)	Days of fast	Indirect calori- metry (cal.)	Respi- ratory quotient	Work in meters trav- elled	Calories above the basal per 1000 meters travelled	Kilogram- meters required
March 29 . . . . .	28	8.75	3	73.7	0.71	4 796	12.06	0.584
» 30 . . . . .	29	8.6	4	16.0	0.74	—	—	—
» 31 . . . . .	30	8.55	5	70.2	0.724	4 719	11.5	0.570
April 2 . . . . .	31	8.35	7	15.0	0.74	—	—	—
» 3 . . . . .	32	8.1	8	14.3	0.715	—	—	—
			8	70.8	0.719	*5 023	11.2	0.587
» 5 . . . . .	33	8.2	9	14.4	0.73	—	—	—
» 9 . . . . .	34	7.6	13	12.4	0.75	—	—	—
»	—	—	13	62.7	0.717	*4 710	10.6	* 0.595

\* Average = 0.584 kilogrammeters.

**INFLUENCE OF MECHANICAL WORK DURING FASTING.** — The dog having lost about 20 % of its weight after 13 days' fasting, performed the same mechanical work with an average expenditure of energy of 0.584 kilogram-

(1) Term used by RUBNER to express the loss of energy peculiar to certain foodstuffs caused by the changes they undergo in the organism. (See B. 1914, p. 435, ZUNTZ, N. *Experiments and Points of View in the Study of Animal Metabolism with the Aid of the Respiratory Apparatus.* (Ed.)

meters (see Table II). If the results obtained during fasting are compared with those obtained when the animal is in the best nutritive condition (see Table I) it is seen that, to accomplish the same amount of work, the same expenditure of energy is required in both cases, in spite of the fact that, in the first, the dog has lost 20 % of its weight.

CONCLUSION. — To move 1 kilogram of body substance 1 meter through space the animal requires a *constant* expenditure of energy (0.580 kilogram-meter on the average), *independent* of its weight and of the specific dynamic action of the foods ingested. Only an abundant supply of glucose reduces slightly this expenditure.

#### FEEDS AND FEEDING

- 315 - **The Effect of High Temperature on the Nutritive Value of Foods.** — HOGAN, ALBERT G., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 115-123 + 9 diagrams. Baltimore, May, 1917.

The experiments described were made on rats in the Department of Chemistry of the Kansas Agricultural Experiment Station, Manhattan.

In a previous paper (*Journal of Biological Chemistry*, Vol. XXVII, p. 193, 1916) the author showed that young rats are unable to grow on a diet that has been subjected to high temperatures. Many investigators believe the so-called accessories to be destroyed by exposure to heat. In order to verify this hypothesis the author undertook new experiments, using as food maize and a mixture of maize and white of egg, one or both of which had been heated in the autoclave for 6 hours under a 30 lbs. pressure. It was found that heat had little or no effect on the white of egg, but that each time the maize was heated the diet became inadequate in some respect. To ascertain whether the protein had been changed, a relatively pure protein — white of egg — was heated in the autoclave for 6 hours at a 30 lbs. pressure. This protein was carefully dried and mixed with protein-free milk, butter, starch and agar in such proportions that the protein formed about 9 % of the ration. In further experiments, for the white of egg was substituted unheated casein (control) and casein heated in the autoclave for 2 hours under a pressure varying from 15 to 45 lbs. It was seen that the action of heat caused no essential modification of the food value of either the white of egg or the casein.

The author concludes that heating such as carried out in his experiments does not materially decrease the food value of proteins. The hypothesis that one or more of the so-called food accessories may be injured by high temperatures seems justified.

- 316 - **The Supplementary Dietary Relationship between Leaf and Seed as Contrasted with Combinations of Seed with Seed.** — MCCOLLUM, E. V., SIMMONDS, N. and PITZ, W., in *The Journal of Biological Chemistry*, Vol. XXX, No. 1, pp. 13-32 + 14 diagrams. Baltimore, May, 1917.

At the Agricultural Station of Wisconsin, Madison, the authors had previously carried out a series of preliminary feeding experiments with a number of natural foods of one variety completed by the addition of one or more isolated and chemically pure dietary factors (protein, mixture of

inorganic salts, fat-soluble A, water-soluble B\*). In this way they studied wheat (1) maize (2), rice (3), oat kernels (4) and white beans (5).

With the exception of polished rice and beans these seeds resemble each other closely in their dietary properties: — a) the proteins are of relatively, poor quality furnishing certain essential amino-acids in amounts below the optimum.; b) the content and composition of the inorganic portion of each seed are of a character which cannot induce normal growth and must be corrected by certain salt additions; c) the content of the fat-soluble A is inadequate to supply the needs of a growing animal over a prolonged period. Unpolished rice closely resembles the other seeds mentioned above, but polished rice, which has lost both its bran layer and its germ, is deficient, not only in the above-mentioned factors, but also in water-soluble B. The common bean differs from the other seeds particularly in the poor quality of its proteins. These contain but little of one or more of the essential amino-acids, so that beans should always be combined with other natural foods capable of supplying the proteins which supplement this deficiency.

In the paper under review the authors give data obtained recently which clearly show the general lines along which successful nutrition may be obtained when the diet is purely vegetarian. Their experiments, which have lasted over 10 years, carried out with rats and pigs, convinced them that these two species have essentially the same food requirements. Neither species can grow satisfactorily when restricted to one of the cereal grains; as regards growth and reproduction both respond in the same way to specific modifications of a diet thus restricted. In the experiments described, made with rats, it was found impossible to make up a ration derived solely from the seeds of plants capable of giving normal nutrition during the growing period, even though two to five seeds of widely different varieties were employed. When the animals were put on a simple and unvaried diet of a mixture of leaves (alfalfa) and seeds, very different results were obtained.

It was impossible to secure appreciable growth with the following mixtures of seeds with salt-free water.

- 1) maize 90, flaxseed oil meal 10;
- 2) wheat 20, maize 20, rolled oats 20, hemp seed 20, millet seed 20;

(1) HART, E. B., MCCOLLUM, E. V., STEENBOCK, H. and HUMPHREY, G. C., *Wisconsin Agricultural Experiment Station Research Bulletin* 17, 1911; HART and MCCOLLUM, *Journal of Biological Chemistry*, Vol. XIX, p. 373, 1914; HART, E. B., MILLER, W. S. and MCCOLLUM, E. V., *ibid.*, Vol. XXV, p. 239, 1916; MCCOLLUM, E. V., SIMMONDS, N., and FITZ, W. *ibid.*, Vol. XXVIII, p. 211, 1916-1917. — (2) HART and MCCOLLUM, *Journal of Biological Chemistry*, Vol. XIX, p. 373, 1914; MCCOLLUM, SIMMONDS and FITZ, *ibid.*, Vol. XXVIII, p. 153, 1916-1917. — (3) MCCOLLUM, E. V. and DAVIS, M., *Journal of Biological Chemistry*, Vol. XXIII, p. 181, 1915. — (4) MCCOLLUM, SIMMONDS and FITZ, *Journal of Biological Chemistry*, Vol. XXIX, p. 341, 1907. — (5) MCCOLLUM, SIMMONDS and FITZ, *Journal of Biological Chemistry*, Vol. XXIX, p. 521, 1917.

See also B. March, 1915, No. 296.

\* For the explanation of these terms see R. Jan., 1918, No. 2.

(Ed.)

(Ed.)

3) wheat 25, maize 25, rolled oats 25, hemp seed 25 ;

4) wheat 33, maize 33, rolled oats 33.

These rations represent two distinct types ; rations 1 and 2 promote good growth if suitable inorganic salts are added, but not otherwise ; ration 3, after a period of suspended growth, responds less well to the addition of salts in its effects than the two preceding rations ; ration 4 does not support growth. This shows that rations 1 and 2 contain a sufficient quantity of the factors fat-soluble A and water-soluble B, as well as proteins of adequate quality and enough assimilable energy as carbohydrate and fat. The preceding experiments (described above) showed that maize, wheat and oats contained an insufficient amount of the fat-soluble A, and it is, therefore, evident that flaxseed meal and millet seed contain a much greater

*Inorganic constituents of vegetable foodstuffs (per cent.)*

Vegetable	Ash	K	Na	Ca	Mg	P	Cl
<i>Leaf</i>							
Alfalfa hay . . . . .	7.38	1.64	0.01	2.14	0.22	0.34	0.29
Rape green . . . . .	8.08	2.23	0.23	1.26	0.18	0.40	0.61
Red Clover . . . . .	6.86	1.84	0.10	1.71	0.45	0.29	0.26
Rhubarb . . . . .	14.49	7.14	0.55	1.04	—	0.93	0.77
Spinach . . . . .	16.48	2.27	4.32	1.40	0.63	0.74	1.04
Cabbage heart . . . . .	10.85	2.51	0.80	1.66	0.23	0.71	0.85
<i>Seed</i>							
Hulled rice . . . . .	0.39	0.07	0.016	0.009	0.026	0.09	0.0004
Maize . . . . .	1.55	0.32	0.05	0.01	0.12	0.33	0.045
Wheat . . . . .	2.08	0.50	0.02	0.04	0.14	0.40	0.06
Oatmeal . . . . .	1.83	0.36	0.06	0.01	0.09	0.38	0.10
Beans . . . . .	3.63	1.25	0.03	0.13	0.16	0.61	0.06
Cottonseed meal (extracted with solvents). . . . .	7.48	1.85	—	0.23	0.68	1.50	0.003
Linseed meal (extracted with solvents). . . . .	5.84	1.18	0.07	0.35	0.55	0.80	0.01
<i>Tuber or root.</i>							
Potato . . . . .	3.79	1.90	0.08	0.07	0.11	0.28	0.13
Sweet potato . . . . .	3.07	1.28	0.15	0.22	0.06	0.14	0.39
Beet . . . . .	5.97	0.84	2.16	0.25	0.01	0.25	0.29
Turnip . . . . .	8.01	3.02	0.58	0.60	0.18	0.44	0.40
<i>Fruit</i>							
Oranges . . . . .	3.08	0.93	0.31	0.54	0.15	0.15	0.07
Apples . . . . .	1.44	0.43	0.28	0.04	0.07	0.08	—
Plums . . . . .	2.08	1.20	0.03	0.06	0.06	0.12	0.007
Raisins . . . . .	2.86	1.10	0.16	0.10	0.10	0.22	0.14
Figs . . . . .	2.92	1.35	0.05	0.23	0.10	0.16	0.06

amount of this dietary factor. This is confirmed by the results obtained with ration 3 which contains neither flaxseed meal nor millet seed. Ration 4 is deficient, not only in the fat-soluble A, but also in salts.

*It is difficult, if not impossible, to obtain even moderate growth over an extended period on a diet restricted to the seeds of plants.* Since the water-soluble B is abundant in all the seeds, and the fat-soluble A present in large quantities in some of them, the failure of the seeds to promote growth must be attributed to the composition of their inorganic fraction. Of the seven seeds most important for human nutrition and animal production (rice, maize, wheat, oats, beans, cotton, flax) only cottonseed and flaxseed have a high inorganic content, and in all of them, as with seeds in general, the ash is very poor in sodium, calcium and chlorine.

The following data are taken from the paper by E. B. FORBES, *Ohio Agricultural Experiment Station Bulletin* 207, 1909.

The leaf and seed rations used to ascertain how far leaves can supplement the deficiencies of the seeds were : —

- 5) rolled oats 50, alfalfa 50 ;
- 6) rolled oats 60, alfalfa 40 ;
- 7) rolled oats 70, alfalfa 30 ;
- 8) wheat 60, alfalfa 40 ;
- 9) wheat 70, alfalfa 30 ;
- 10) maize 60, alfalfa 40 ;
- 11) maize 70, alfalfa 30 ;
- 12) maize 80, alfalfa 20 ;
- 13) maize 90, alfalfa 10 ;
- 14) peas 60, alfalfa 40.

The results obtained led to the following conclusions : —

*The leaf is distinctly different from the seed in its dietary properties in two respects: — its total inorganic content is very high, and it is especially rich in both sodium and calcium, both of which are deficient in the seeds generally.* In addition the leaf is several times richer in fat-soluble A than are wheat, oat and maize kernels. Certain seeds contain this substance to nearly the same extent as the leaf; hemp seed is distinctly superior in this respect to the seeds just mentioned, and flaxseed and millet seed are still richer than hemp seed. The fat-soluble A content is highest in the smallest seeds, probably because of the relatively large proportion of germ contained in them.

317 - **Indian Cattle Census.** — *The Agricultural Journal of India*, Vol. XII, Part. IV, p. 676. Pusa, October, 1917.

The following figures, recently published by the Director of Statistics of India are based on cattle censuses which are taken annually in some provinces and quinquennially in others. It is stated that a general census for all provinces will be taken during the year 1919-1920.

The total number of cattle in British India is 147 336 000. Of this, bulls and bullocks account for 48 664 710, cows for 37 481 273, buffaloes for 19 025 079, and young stock for 42 184 790. The following are the provincial figures: —

STOCK RAISING:  
ORGANISATION  
AND  
ENCOURAGE-  
MENT

United Provinces	31 741 000	22 % of total	Burma . . . . .	5 882 000	} 0 % of total
Bengal. . . . .	25 324 000	17 %	Assam . . . . .	3 576 000	
Madras . . . . .	21 761 000	15 %	NorthWest Frontier Province. .	1 271 000	
Bihar and Orissa	20 119 000	14 %	Ajmer-Merwara . . . . .	351 000	
Punjab . . . . .	15 489 000	11 %	Dehli. . . . .	148 000	
Central Provinces and Berar	11 857 000	8 %	Coorg . . . . .	131 000	
Bombay and Sind	9 677 000	7 %	Manpur. . . . .	6 000	

The number of cattle per 100 acres of cropped area ranges between 32 in Bombay and Sind and 100 in Bengal, while the number per 100 of population ranges between 36 in Dehli and 95 in the Manpur Pargana. The average for British India as a whole is 65 per 100 acres of cropped area and 61 per 100 of population.

The number of sheep is given at 23 015 836, of which Madras possesses 10 765 543 and the Punjab 4 676 899. The number of goats was 33 338 487, horses and ponies, 1 653 379, and mules and donkeys, 1 512 205.

The statistics relating to sheep, goats, horses, and ponies, and mules and donkeys, exclude Bengal, from which no returns regarding these animals are at present received.

318 - **Herd Books of the Argentine Rural Society** (r). — DE ANCHORENA J., in the *Anales de la Sociedad Rural Argentina*, Year I, II, Vol. L, L, pp. 642-644. Buenos Ayres, October 1917.

The appended tables give a summary of the entries in the herd books of the Argentine Rural Society for the last year (October 1, 1916-September 1917) and since their foundation. All pure breeds of cattle, horses, asses, sheep and pigs, whether produced in or imported into the Argentine, are included.

#### A. — Argentine Herd Book.

Breeds.	Entries from October 1, 1916 to September 35, 1917					Entries since foundation.		
	Imported animals		Animals born in the country		Total	Imported and home-bred animals		
	Males	Females	Males	Females		Males	Females	Total
Shorthorn . . . . .	638	79	4 671	4 542	9 930	50 640	53 123	103 763
Hereford . . . . .	16	—	725	800	1 541	9 354	11 544	20 948
Aberdeen Angus . . . . .	42	23	492	458	1 015	4 543	4 806	9 349
Red Shorthorn . . . . .	1	—	6	5	12	145	201	346
Red Polled . . . . .	—	—	12	13	25	111	125	236
Devon . . . . .	—	—	5	3	8	20	23	43
Jersey . . . . .	—	—	9	8	17	44	51	95
Flemish . . . . .	—	—	33	22	55	167	487	654
<b>Totals . . . . .</b>	<b>697</b>	<b>102</b>	<b>5 953</b>	<b>5 851</b>	<b>17 603</b>	<b>22 024</b>	<b>70 410</b>	<b>135 434</b>

(1) See R., February, 1916, No. 202. (Ed.)



*B. Argentine Stud Book.*

Breeds	Entries from October 1, 1916 to September 30, 1917			Entries since foundation		
	Males	Females	Total	Males	Females	Total
Percheron . . . . .	285	383	668	2 605	5 878	8 483
Clydesdale . . . . .	129	199	328	1 975	4 890	6 865
Shire . . . . .	118	165	283	1 721	3 364	5 085
Hackney . . . . .	123	120	243	1 923	2 804	4 727
Yorkshire . . . . .	25	27	52	287	731	1 018
Anglo-Norman . . . . .	10	21	31	192	671	863
Suffolk-Punch . . . . .	9	4	13	190	523	713
Boulonnais . . . . .	8	4	12	152	197	349
Hunter . . . . .	9	22	31	62	173	235
Orloff . . . . .	—	—	—	87	110	197
Polo-Pony . . . . .	6	7	13	66	86	152
Belgian . . . . .	—	3	3	21	73	94
Shetland-Pony . . . . .	—	—	—	10	24	34
American-trotting . . . . .	2	—	2	7	23	30
Oldenburg . . . . .	—	1	1	10	16	26
Holstein . . . . .	—	2	2	10	13	23
<i>Totals . . .</i>	<b>124</b>	<b>958</b>	<b>1 682</b>	<b>9 318</b>	<b>19 516</b>	<b>28 894</b>

*C. — Argentine Ass Book.*

Breeds	Entries from October 1, 1916 to September 30 1917		
	Males	Females	Total
Poitou . . . . .	26	92	118
Ausetana . . . . .	23	69	92
<i>Total . . .</i>	<b>49</b>	<b>161</b>	<b>210</b>

D. — *Argentine Flock Book.*

Breeds	Entries from October 1, 1916 to September 30, 1917					Total breeding animals entered in the final register and preliminary to the same period.			
	Imported animals		Homebred animals		Prelimi- nary re- gister.	Final		Prelimi- nary	Total
	Males	Females	Males	Females	Females	Males	Females	Females	
Lincoln . . . . .	702	50	1 495	1 691	1 016	2 927	8 858	9 745	21 530
Argentine Merino . .	4	9	486	423	—	1 317	8 155	—	4 472
Shropshire Down . .	24	—	13	13	18	71	342	152	565
Hampshire Down . .	5	—	66	87	29	124	367	211	7-2
Oxford Down . . . .	18	3	85	89	3-6	84	326	1 033	1 413
Romney Marsh . . . .	44	—	193	253	86	175	847	394	1 416
Border Leicester . .	—	—	34	52	—	39	180	—	219
Dixley . . . . .	—	—	3	3	—	3	3	—	6
Corriedale . . . . .	—	—	—	—	—	1	—	5	51
<i>Total . . . . .</i>	<i>795</i>	<i>59</i>	<i>2 375</i>	<i>2 624</i>	<i>2 453</i>	<i>4 741</i>	<i>14 078</i>	<i>11 585</i>	<i>30 404</i>

R. — *Argentine Swine Book.*

Breeds	Entries from October 1, 1916 to September 30, 1917			Entries since foundation		
	Males	Females	Total	Males	Females	Total
Berkshire . . . . .	679	961	1 640	4 895	6 247	11 142
Middle White York- shire . . . . .	183	134	257	1 511	2 023	3 534
Tamworth . . . . .	88	159	244	170	301	471
Large Black . . . . .	102	122	230	1 274	1 400	2 674
Duroc-Jersey . . . .	22	30	52	58	71	129
Poland-China . . . .	—	—	—	111	134	245
Large White . . . . .	—	—	—	43	67	101
Hampshire . . . . .	—	—	—	4	6	10
<i>Total . . . . .</i>	<i>1 017</i>	<i>1 406</i>	<i>2 423</i>	<i>8 066</i>	<i>10 259</i>	<i>18 325</i>

319 — The Stud Beef Cattle Breeders' Association of Australia. — *The Pastoral Review*. Vol. XXVII, No. 10, p. 933. Melbourne, October 16, 1917.

The movement initiated in Sydney about three months ago in the direction of forming a stud beef cattle breeders' association received official endorsement when the members of the *Stud Beef Cattle Breeders' Association of Australia* met in general meeting to consider and adopt the rules and regulations drawn up by the provisional council.

The future value of the organisation in fostering pure cattle breeding was generally recognized, as well as the fact that the opportunities of doing

valuable work in this direction in Australia are boundless. The men who have been elected to manage this new Association are well-known and successful breeders from the various States of the Commonwealth and are fully competent to make it an unqualified success.

320 — **On the Use of Certain Marine Algae for Feeding Horses.** — ADRIAN, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 1, pp. 54-56. Paris, January 7, 1918.

HORSES

The author, having been offered a product obtained from *Laminarias* to be used for waterproofing cloths, noticed that the composition of the treated seaweed resembled that of oats, as is shown by the appended figures: —

	Laminarias treated	Oats
Water . . . . .	14.40 %	12.55 %
Carbohydrates . . . . .	52.90	66.80
Nitrogenous matter . . . . .	17.30	9.10
Cellulose . . . . .	11.50	8.45
Ash. . . . .	3.90	3.10

The author tried the product on 2 lots of 3 horses suffering from lymphangitis; one lot, used as control, was given the ordinary feed of oats, hay, straw, while for the second the seaweed replaced the oats.

After 24 days, it was found that the horses fed on seaweed had increased in weight by 6 %, while their general condition was much improved, and the lymphangitis had disappeared, though still persisting in the first lot. This action on the disease, if it is confirmed, might possibly be due (according to MM. LAPICQUE and LEGENDRE of the Museum, who were consulted on this question) to the traces of organic iodine in the algae.

One certain result was obtained: — horses had eaten, digested and assimilated the new food replacing oats.

A further experiment was tried with 2 lots of 20 cavalry horses; the first lot were fed normally, while the second received 1 kg. of alimentary seaweed replacing 1 kg. of oats.

The experiment, which lasted 2 months, confirmed the previous one; the horses fed on the seaweed had put on 13 kg. by the end of the trial, while the control horses had barely gained 2 kg.

The author considers 0.750 kg. of alimentary seaweed to be equivalent to 1 kg. of oats.

The experiment is all the more interesting since *Laminarias* are abundant on the coast of Brittany. The author discusses their use in human nutrition, as regards which very interesting results have been obtained.

321 — **Relation between the Weight of the Carcass and that of the Meat in Beef Cattle.** — DECHAMBRE, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 1, pp. 25-28. Paris, January 9, 1918.

CATTLE

The meat obtained from an animal is equal to the difference between the net weight and the total weight of the bones, suet, etc. The most

important of these factors is the carcass, a knowledge of which would form a sound basis for the selection of slaughter breeds.

The relation between the weight of the carcass and that of the meat is influenced by many factors, such as age, sex, breed, maturity, and, above all, the condition of the animal produced by the degree of fattening. The author's experiments to determine this relation were carried out with a large number of animals, representing a total weight of meat of 51 031 lbs. in quarters containing 9 788 lbs. of bone. The average ratio of bone to meat is, therefore, 19.18 %. The extent of fattening greatly influences this ratio. It is usually expressed by the yield per cent. in meat, which is the ratio between live weight and the weight of the quarters. In the meat studied the extent of fattening is dependent on the amount of suet removed for preserving. The author, therefore, determined this amount and calculated its ratio to the weight of the quarters. When this ratio is compared with that between the bone and meat, it is seen that the figures vary inversely: — the fatter the animal the lower the proportion of bone.

The author's conclusions are: — 1) in medium fat and fat cattle, which generally give a net yield of meat varying between 55 and 58 %, the ratio between bone and meat is between 16 and 18 %; 2) in animals in good condition, yielding 50 to 52 %, the ratio is, on an average, 20 %; 3) in animals yielding less than 50 % (47 to 49 %), the ratio rises to 22 %, or a little more (22.63 %), though still below the 25 % generally admitted in the meat trade.

**322 - A Statistical Study of Body Weights; Gains and Measurements of Steers During the Fattening Period.** — SEVERSON, B. O. and GERLANGH, P., in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 383-394 + Plates 38-39. Washington, D.C., Nov., 1917

During the winter months of 1914-1915, 1915-1916 and 1916-1917, a series of body measurements of steers were made at the Pennsylvania Experiment Station, at the beginning and close of feeding experiments, for three consecutive years, with the purpose of determining the average body measurements of 2-year-old steers at the beginning and close of the fattening period and the relationship of other definite body measurements to each other, and to note those measurements that could be used in selection as a means of reducing the experimental error in feeding experiments and a study of variation in the measurements themselves. Another object was to find out the correlation of gains to initial body measurements and to changes in body dimensions.

All measurements taken on a total of 216 animals divided into seven lots each year are indicated in Table I. These steers were relatively uniform as feeders, varying in market grades from "fair" to "choice", the majority being "good" feeders; 92 were Hereford grades, 84 Shorthorn grades, 18 Aberdeen Angus grades, 7 Shorthorn × Hereford crosses, 3 Shorthorn × Aberdeen-Angus crosses, and 3 Hereford × Aberdeen-Angus crosses. In no case did a steer fail to show some infusion of improved beef blood. The average initial weight of the 216 steers was 900.112 pounds with 700 and 1300 pounds as extremes. The steers

were as uniform in quality, weight, and condition as would ordinarily be obtained for feeding purposes. Each year 60 steers were divided into five lots of 12 each selected with as much care for uniformity of weight, breeding, condition and quality as possible. The feeding of these various lots was done with rations affording very nearly the same opportunity for gains in live weight and condition of flesh for marketing.

Table I includes all records for the three years, while the correlation tables include the data during the first two years. All body measurements except circumferences were made with the steel caliper; all circumferences were measured with a steel tape graduated in inches. The probability of error in measurements is a factor not considered, thus necessitating a larger number of measurements to reduce the probable error.

TABLE I. — *Average initial and final measurements of 2-year-old steers fattened for market during a 140-day feeding period.*

Measurement	Initial measurement.		Final measurement.		Difference in measurements	Percentage increase
	Number of steers	Average	Number of steers	Average		
		Pounds		Pounds	Pounds	
Weight . . . . .	216	900 112	216	1,188.398	288 286	32.02
		Inches		Inches	Inches	
Width of head . . . . .	214	8.832	216	9.112	0.280	3.16
Length of head . . . . .	214	19.411	216	19.892	0.481	2.48
Length of neck . . . . .	103	19.163	72	20.990	1.827	9.53
Width of shoulders . . . . .	214	16.412	215	18.459	2.047	12.42
Width of front flank . . . . .	214	16.378	216	18.358	1.980	12.08
Width of paunch . . . . .	214	23.612	216	26.101	2.489	10.54
Width of rear flank . . . . .	154	19.527	216	22.744	3.217	16.42
Width of loin . . . . .	209	13.984	216	15.958	1.974	14.11
Width of hips . . . . .	202	17.662	216	19.254	1.592	9.01
Width af thurls (Hip joint) . . . . .	209	17.204	215	18.533	1.329	7.72
Buttock to hip . . . . .	214	18.366	216	19.622	1.256	6.83
Depch of chest . . . . .	154	26.730	215	27.789	1.059	3.96
Shonlder point to ground . . . . .	214	33.033	216	34.311	1.278	3.86
Chest to ground . . . . .	214	22.876	216	24.013	0.237	1.03
Hind flank to ground . . . . .	214	29.128	216	30.202	1.074	3.68
Hock to ground . . . . .	142	20.795	204	20.914	0.119	0.57
Withers to ground . . . . .	214	49.224	216	53.870	4.646	9.43
Hips to ground . . . . .	202	50.855	214	52.411	1.556	3.05
Shonlder to buttock . . . . .	214	53.763	216	57.988	4.225	1.85
Circumference of chest . . . . .	214	73.014	216	77.694	4.680	6.40
Circumference of paunch . . . . .	214	80.256	216	88.301	8.045	10.02
Circumference of hind flank . . . . .	214	71.364	216	78.685	7.321	10.25
Circumference of muzzle . . . . .	141	17.198	143	17.930	0.832	4.83

These 216 steers gained at the rate of 2.058 pounds daily for 140 days.

The following average initial measurements show a marked similarity: the length of head, length of neck, and width of rear flank, which

vary from 19.163 to 19.527 inches; the width of shoulder and front flank differ by only 0.034 inch; the hips and thurls (hip joint) in width are 17.682 inches and 17.204 inches, respectively; and circumference of the body in the region of the chest and hind flank are 73.014 and 71.364 inches respectively. The height at the withers of a "feeder" steer is 1.631 less than the height at the hips. The length of body from shoulder point to buttock is only 2.908 inches greater than the greatest height at the hips.

The average measurements at the conclusion of the fattening period show similarity as follows: The length of head, width of hips, and distance of buttock from hips varying within 0.638 inch of each other; the width of shoulder, front flank, and thurls are almost identical; and the circumference of the chest and hind flank are more alike than their initial measurements.

The height has increased more at the withers than at the hips; thus a 2-year-old steer changes his greatest height from the hips to the withers while receiving market conditions. In circumference the increase was greater for the hind flank than for the chest; thus the greater circumference of the chest at the initial measurement becomes less than the circumference of the hind flank in the finished steer. In fattening, the greatest width at paunch and the greatest depth of body at the chest become more nearly alike, as shown by a difference of 3.118 inches at the initial measurement and 1.688 inches at the concluding measurement.

In all cases the difference between the initial measurement and the final measurement shows an increase in dimensions due to depositions of fat, muscular development and growth. The regions of the body covered by the greatest amount of muscular development show greater increased dimensions than those having less muscular covering.

In the regions where the growth would show the greater relative influence the least changes take place as shown in the width of head, length of head, distance from chest to ground and hock to ground. The greatest increase in width took place in the hind flank rather than in the paunch, where it would seem natural to have the greatest increase because of feed capacity and condition. The thick layer of flesh and fat deposits in the region of the hind flank, together with the distension of this region of the body in a fattened steer, are responsible for the greater width in this part of the body. The width of loin, hips, thurls, shoulders, and front flank shows changes in dimensions caused mainly by increased condition of flesh.

The increase in height at the withers of 4.646 inches is not all due to growth alone, a larger portion of this increase being caused by the flesh covering over the withers and the deposition of fat in the muscular tissues of the shoulder region. The fat deposit and muscular development causes the shoulder blade to be held more rigidly; thus, the body in the chest region rises between the shoulder blades, as indicated by the greater distance between the withers and the upper border of the shoulder blade. The greatest change in the body measurements was the circumference of the paunch. This, however, was proportionately less than the increase of 7.321 inches in circumference of the hind flank. The fact that the distance of chest to

ground and hind flank to ground did not show greater difference was due to lowering of the flank by deposition of fat in that region and the fat covering over the region of the chest. The region of the body possessing the most valuable eatable parts on the whole are affected most in the fattening process.

**CORRELATION TABLES.** The following table is here presented as illustration of the methods used in obtaining the facts presented in tables III and IV.

TABLE II. — *Correlation of average daily gain of steers during a feeding period of 120 to 140 days and the weight at the beginning of a feeding period.*

Daily gain (pounds)	Initial weight per steer (pounds)													Total
	1 300	1 250	1 200	1 150	1 100	1 050	1 000	950	900	850	800	750	700	
3.2	—	—	—	—	—	—	—	1	—	—	—	—	—	1
3.0	—	—	—	—	—	—	—	—	—	—	—	—	—	0
2.8	—	—	—	—	1	1	3	1	1	2	1	1	—	11
2.6	—	—	—	—	—	4	2	2	4	1	3	3	1	20
2.4	—	1	—	1	2	1	5	8	11	7	6	3	2	47
2.2	—	1	—	2	2	—	4	7	4	7	4	5	—	36
2.0	1	1	—	3	—	1	4	7	9	16	9	12	2	65
1.8	—	1	—	3	2	2	5	7	11	10	9	7	6	63
1.6	—	—	1	—	—	1	5	3	5	4	4	5	4	32
1.4	—	—	—	1	2	—	4	4	10	3	7	1	1	33
1.2	—	—	2	—	—	2	2	4	2	6	2	1	1	22
1.0	—	—	—	—	—	—	—	1	2	—	1	1	—	5
0.8	—	—	—	—	—	1	—	—	2	—	—	—	—	3
Total	1	4	3	10	9	13	34	45	61	56	46	39	17	338
Mean live weight. . . . . pounds 893.93 ± 3.94														
Mean daily gain . . . . . do. 1.95 ± .016														
Standard deviation of live weight. . . . . do. 106.88 ± 2.777														
Standard deviation of daily gain . . . . . do. 0.446 ± .011														
Correlation. . . . . do. 0.0364 ± .036														

The results shown in table III are based on data collected on steers during the two winter periods of 1914-15 and 1915-16. All measurements considered in this table are initial measurements, except those that show increases of dimensions at the close of the fattening period as compared with the initial measurements. The coefficient of variation is shown to be greatest on increases in circumference of hind flank, paunch, and chest, and the increase in gains in live weight.

These measurements all relate to increased dimensions and occur in those parts of the body that show relatively high percentage increase over initial body measurements (Table I).

Of the initial measurements the greatest coefficient of variation is 11.9 ± 0.04 per cent for initial live weight. In all the chest measurements the coefficients of variation are relatively high: Width at point of shoulder

9.3  $\pm$  0.52, width of fore flank 10.4  $\pm$  0.6, depth of chest 6.1  $\pm$  0.34, and circumference of chest 6.9  $\pm$  0.39. Likewise the mid and posterior regions of the body show variations, the rear flank with a coefficient of variation of 8.7  $\pm$  0.48, circumference of rear flank 6  $\pm$  0.34, width of loin 7.5  $\pm$  0.43, width of thurls 5.9  $\pm$  0.34, circumference of paunch 11  $\pm$  0.62 and distance of hips to buttock 5.2  $\pm$  0.29.

The measurements affected most by growth show the least variations and include the distance of shoulder point, rear flank, and withers from the ground, length of head, and distance of shoulder point to buttock.

In general Table III shows the greatest variation in those regions of the body which change most in a fattening steer and those regions affected most by deposition of fat and development of muscular tissue.

TABLE III. — *Means, standard deviations, and coefficients of variation presented in correlation tables.*

Number of steers	Measurements	Mean	Standard deviations	Coefficient of variation
		pounds	pounds	Per cent
388	Average daily gain . . .	1.93 $\pm$ 0.016	0.446 $\pm$ 0.011	23.1 $\pm$ 0.84
388	Initial live weight . . .	893.93 $\pm$ 3.94	106.88 $\pm$ 2.77	11.9 $\pm$ .04
142	Total gain in live weight	288.55 $\pm$ 3.10	54.77 $\pm$ 2.19	19.1 $\pm$ 1.08
		Inches	Inches	
142	Increase in circumference of chest . . . . .	8.13 $\pm$ .10	1.87 $\pm$ .074	23.0 $\pm$ 1.30
142	Width of rear flank. . .	19.25 $\pm$ .09	1.69 $\pm$ .06	8.7 $\pm$ .48
142	Circumference of rear flank	72.76 $\pm$ .25	4.40 $\pm$ .17	6.0 $\pm$ .34
142	Height of shoulder point	34.10 $\pm$ .08	1.57 $\pm$ .06	4.5 $\pm$ .25
142	Height of rear flank . .	30.23 $\pm$ .09	1.67 $\pm$ .06	5.5 $\pm$ .31
142	Distance, hip to buttock	18.69 $\pm$ .05	.99 $\pm$ .03	5.2 $\pm$ .29
137	Width of loin . . . . .	13.96 $\pm$ .06	1.05 $\pm$ .22	7.5 $\pm$ .43
142	Circumference of chest .	69.82 $\pm$ .22	3.91 $\pm$ .01	6.9 $\pm$ .39
142	Depth of chest . . . . .	25.77 $\pm$ .08	1.59 $\pm$ .063	6.1 $\pm$ .34
142	Width of fore flank. . .	15.02 $\pm$ .08	1.57 $\pm$ .06	10.4 $\pm$ .60
142	Distance, chest to ground	22.89 $\pm$ .06	1.18 $\pm$ .04	5.1 $\pm$ .28
136	Width of thurl. . . . .	17.36 $\pm$ .05	1.03 $\pm$ .04	5.9 $\pm$ .34
142	Length of head. . . . .	19.53 $\pm$ .04	.81 $\pm$ .03	4.1 $\pm$ .23
142	Length of shoulder to buttock . . . . .	55.66 $\pm$ .17	3.02 $\pm$ 2.84	5.4 $\pm$ .30
142	Increase in circumference of paunch . . . . .	8.26 $\pm$ .16	2.96 $\pm$ .11	35.8 $\pm$ 2.02
142	Height of withers. . . .	49.50 $\pm$ 1.07	1.95 $\pm$ .07	4.9 $\pm$ .27
142	Width at point of shoulder	16.42 $\pm$ .08	1.54 $\pm$ .06	9.3 $\pm$ .52
142	Circumference of paunch.	81.60 $\pm$ .56	10.04 $\pm$ 4.02	10.0 $\pm$ .62
138	Increase in circumference of rear flank . . . . .	7.52 $\pm$ .20	3.51 $\pm$ .14	46.6 $\pm$ 2.67

Table IV, a summary of the coefficients of correlation, shows that increases in body measurements have a closer relationship with gains in live weight than the initial measurements. With the exception of initial weight



these measurements, as shown in Table II, also had high coefficients of variation.

The correlation coefficients for the two body circumferences of chest and rear flank, the width of thurls (hip joint), and the distance of hip to buttock show the closest relationship of all the initial measurements with gains in live weight. This suggests the possibilities of using these measurements in the selection of feeding steers, at least for experimental purposes, as a means of reducing the experimental error caused by individuality of animals.

The measurement of initial weight shows no relationship with gains, although this is usually considered one of the most important factors in selection of steers for experimental purposes.

Measurements that show intermediate relationship as indicated by coefficients of correlation are width of loin, depth of chest, width of fore flank, length of head, height of withers, circumference of paunch and width at shoulders.

TABLE IV. — *Summary of correlations.*

Correlating	Correlation coefficient	Correlating	Correlation coefficient
Gain with initial live weight	$0.036 \pm 0.036$	Gain with initial length of head	$0.182 \pm 0.037$
Gain with increase in circumference of chest . . . . .	$.460 \pm .044$	Gain with initial length from point of shoulder to buttock	$.020 \pm .056$
Gain with initial width of rear flank . . . . .	$.079 \pm .083$	Gain with increase in circumference of paunch . . . . .	$.306 \pm .036$
Gain with initial circumference of rear flank . . . . .	$.221 \pm .053$	Gain with initial height of withers . . . . .	$.163 \pm .054$
Gain with initial height of point of shoulder . . . . .	$.061 \pm .056$	Gain with initial width of shoulders . . . . .	$.144 \pm .055$
Gain with initial height of rear flank . . . . .	$.053 \pm .055$	Gain with initial circumference of paunch . . . . .	$.124 \pm .055$
Gain with initial length of hip to buttock . . . . .	$.271 \pm .053$	Gain with increase in circumference of rear flank . . . . .	$.203 \pm .055$
Gain with initial width of loin	$.108 \pm .085$	Width of thurls with height of rear flank . . . . .	$.380 \pm .049$
Gain with initial circumference of chest . . . . .	$.238 \pm .053$	Circumference of chest with height of withers . . . . .	$.621 \pm .034$
Gain with initial depth of chest	$.130 \pm .046$	Width of loin with height of chest from ground . . . . .	$.179 \pm .057$
Gain with initial width of fore flank . . . . .	$.164 \pm .054$	Width of chest with depth of chest . . . . .	$.365 \pm .072$
Gain with initial distance of chest to ground . . . . .	$.077 \pm .056$		
Gain with initial width of thurls . . . . .	$.224 \pm .054$		

Measurements in which slight or no relationship exist as shown by correlation coefficients are initial live weight, width of rear flank, height at shoulder point and the distance of rear flank and chest from the ground.

A close relationship of circumference of chest with height of withers

is indicated by  $r = 0.621 \pm 0.034$ . Likewise, the width of chest and depth of chest by  $r = 0.365 \pm 0.072$  show a definite relationship.

The hind quarters of a steer are more important than the fore quarters in determining the gaining capacity of a steer, with the exception of the circumference of chest as shown by a correlation coefficient of  $0.224 \pm 0.054$  for width of thurls,  $0.271 \pm 0.053$  for distance of hip to buttock and  $0.221 \pm 0.053$  for circumference of rear flank.

The following points (see p. 361), held by authoritative judges of live stock to be important, are not substantiated by the results of this study thus far: Initial weight of steers, closeness to the ground of chest and hind flank, and the length of body from shoulder to buttock. The circumference of chest and rear flank are more important in ascertaining gains than feed capacity as indicated by the circumference of paunch.

### 323 - Influence of the Degree of Fatness of Cattle upon their Utilization of Feed. —

ARMSBY, H. PRONTISS and FRIES J. AUGUST, in the *Journal of Agricultural Research*, Vol. XI, No. 10, pp. 451-472, Tables, 1 fig., bibliography of 8 publications. Washington, December 3, 1917.

It is well known that the gain in live weight per unit of feed diminishes as fattening progresses; it is supposed that the cells of the adipose tissues, as they become loaded with fat offer an increasing resistance to the deposition of added fat, to overcome which increased expenditure of energy is required. Consequently a given amount of food gives a smaller gain in fat in a fat animal than in a thin one as a result of a corresponding increase in heat production and a reduction in the net energy value of the feed. Mr. ARMSBY, Director of the Institute of Animal Nutrition of the Pennsylvania State College, and the Assistant Director, Mr. FRIES, have investigated this subject by a direct comparison of the metabolism of an animal in ordinary condition and when well fattened.

#### *Rations and periods.*

Period	Preliminary period	Digestion period	Daily ration	
			Hay	Concentrates
			kg	kg
Period 1	November 2-12	November 13-22	1.7	3.4
Transition	(December 23-29)	—	—	—
Period 2	November 30-Dec. 10	December 11-20	3.5	7.0
Fattening	(Dec. 22-March 14)	—	—	—
Period 3	March 15-25	March 12-April 4	3.8	7.6
Period 4	April 5-15	April 16-25	2.0	4.0

METHOD. — *Subject*: a pure-bred shorthorn steer about 2 years and 9 months old at the beginning of the experiment. — *Rations and periods*: the animal received a basal ration of alfalfa hay and a mixture of concentrates (1 part of cottonseed meal, 2 parts of wheat bran and 6 of maize meal). This ration was always fed in the same proportions — 2 parts of concentrates to 1 part of alfalfa hay — and supplied throughout the experiment, which

was divided into four parts (see the appended table). During two successive periods the animal received quantities of this feed equivalent to a maintenance ration (period 1), and to a fattening ration (period 2). Fattening was then started, during which the steer gained 300 lbs. The experiment was continued in the reverse order, a fattening ration being first given (period 3), then a maintenance ration (period 4).

RESULTS. — These two successive comparisons of metabolism resulted in much data (grouped in a series of tables in the appendix) which lead to the following conclusions: —

1) *The digestibility* of the heavy ration is smaller than that of the light ration; it does not depend on the degree of fattening as corresponding rations were equally well digested before and after fattening.

2) *Urinary excretion.* — The percentage of nitrogen, carbon and energy lost in the urine was less on the heavy than on the light ration, and a little greater in the fattened than in the unfattened animal.

3) *The production of combustible gases*, both as compared with the total feed and with the digestible carbohydrates was notably less on the heavier than on the lighter ration, both before and after fattening.

4) *Value of the gross energy of the feed.* — In consequence of the smaller losses in urine and in combustible gases this loss was greater on the heavy than on the light ration; no difference in this respect was observed between the fattened and the unfattened animal.

5) *The additional heat* produced by the animal on the heavier rations was eliminated by means of evaporation of water.

6) *Energy expenditure consequent on feed consumption.* — The heat increment resulting from the consumption of a unit of feed was only a little greater in the fattened condition; consequently the *net* energy values of the feed and the percentages of metabolizable energy available for gain were slightly less in the fattened than in the unfattened animal.

7) The maintenance requirement was increased by 37 % after 3 months' fattening during which the live weight was increased by 300 lbs. This 36 % increase in basal katabolism was partly due to the greater body weight to be supported while standing, but the katabolism increases more rapidly than the weight or the body surface.

8) *General conclusion.* — The higher maintenance requirement and lower *fixed* metabolizable energy in the fattened animal are the principal factors responsible for slower gain in weight as fattening progresses.

324 - **Breeders of Purebred Stock in Queensland — Beef and Dairy Cattle.** — *Queensland Agricultural Journal*, Vol. VIII, pp. 247-248. Brisbane, November, 1917.

The Department of Agriculture and Stock of Queensland has published in this issue of the *Agricultural Journal* a revised list of breeders of purebred cattle, for the purpose of informing those who desire to improve their stock where the best cattle can be obtained in the State.

The Department of Agriculture and Stock takes no responsibility in relation to the entries in the list; but, when inquiries were first made, the condition was imposed that the entries were to be only of stock that had

been duly registered or that were eligible for registration in the different herd books. As the entries received were, in some cases, somewhat too confusing for proper discrimination, it has, therefore, now been decided that only such cattle as have been registered will be included. This list of breeders of pure bred stock in Queensland shows that all the principal breeds of cattle are represented and that they were registered in 15 different Herd Books, i.e., Milking Shorthorn Herd Book of Queensland; Ayrshire Herd Book of Queensland; Ayrshire Herd Book of Scotland; Holstein Cattle Club Herd Book; Holstein-Friesian Herd Book of Australia; Holstein Friesian Herd Book of Queensland; Jersey Herd Book of Queensland, Herd Book of the Jersey Cattle Society of Queensland; Commonwealth Standard Jersey Herd Book; Illawarra Dairy Cattle Herd Book of Queensland; Illawarra Herd Book of Queensland; Illawarra Dairy Cattle Association; Queensland Shorthorn and Australian Herd Books; Queensland Shorthorn Herd Book; Australian Hereford Herd Book; New Zealand Herd Book.

The total number of purebred males and females owned by these breeders may be discriminated as follows between the different breeds.

	Males	Females
Milking Shorthorns . . . . .	5	61
Ayrshire . . . . .	74	371
Holstein-Friesian . . . . .	22	77
Jersey . . . . .	35	224
Illawarra . . . . .	5	48
Shorthorn . . . . .	27	137
Hereford . . . . .	114	563

## SHEEP

325 — **Machine Sheep-Shearing in New Zealand.** — See No. 340 of this Review.

## PIGS

326 — **Feeding Pigs on Kitchen Waste.** — PRIME, T. F., in *The Journal of the Board of Agriculture*, Year XXIV, No. 10, pp. 1107-1109, London, January, 1918.

Finding no data on the amount of kitchen waste necessary to produce one pound of pork, the author carried out experiments on this subject. To this end he started in January 1917 to keep pigs on this food and continued during 48 weeks. Three pigs were bought on January 9, two of which were killed on March 5; four others were bought on March 10, one being killed on June 7; on September 1, five more pigs were bought. Throughout the experiment 6104 lbs. of food were consumed, and 870 lbs. increase in live weight were obtained, or roughly, 7 lbs. of kitchen waste (potato, vegetable and fruit peelings and waste, bits and remains of food) produced 1 lb. increase in live weight. During the whole period the only other food used was 28 lbs. of meal, given during a shortage of waste. The pork obtained was of excellent quality.

## SERICULTURE

327 — **New Silkworm Rearing Methods; the Acqua Small Trestle System and the Campbell Shelf System.** — ACQUA, C., Rearing early stage silkworms by means of a small trestle with immersed twigs, *Rend. onli dell'Istituto bacologico della R. Scuola Superiore di Agricoltura in Portici*, Vol. II, pp. 3-12, figs. 2; CAMPBELL, C., Some new methods for rearing silkworms, *Ibid.*, p. 23-29, figs. 2. Portici, 1917.

For some years, attempts have been made to diffuse the economic method of rearing employed in Friuli throughout Italy. This system consists

in giving the larvae, after the 3rd. or 4th. stage, leaves attached to the boughs, using horizontal hurdles or special trestles as supports. For the first stages, the Friulian system does not differ from these ordinarily used. The author has a system, by means of which the larvae can be reared on boughs from hatching. To preserve the leaves fresh and tender, and to avoid loss due to the rapid withering of the cut leaf, the lower ends of the branches are kept immersed in a small basin of water, placed on a shelf attached to the lower part of each side of a small trestle, some 20 in.  $\times$  20 in. square, (fig. I). A metal sheet is spread over the trestle, and covered with cardboard, strong paper, or even gauze. The small basin is provided with a stoppered opening, so that the water can be changed without moving the recipient. When the leaves are eaten, fresh boughs are placed with their ends in the water (which has been changed), care being taken to place them close to the old boughs; the young silkworms soon pass on to the fresh

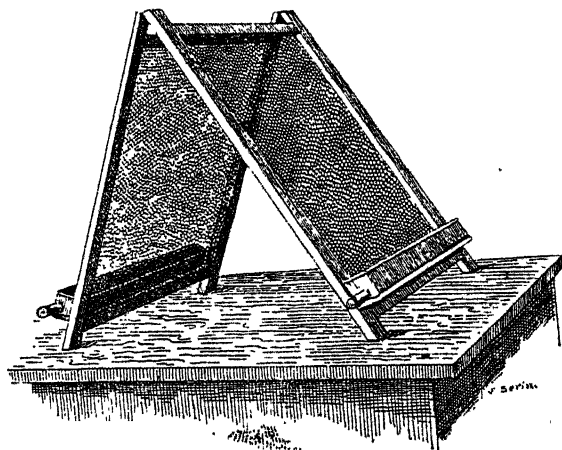


Fig. I. — ACQUA trestle method.

leaves; the day after, the old boughs are removed. Four small trestles suffice for rearing 2 ounces (60 gm.) of eggs up to the end of the second stage; the system may be used for the third stage, by employing larger trestles. Thus, for 2 ounces (60 gm.) of eggs, a trestle, 6 ft. 6 in.  $\times$  6 ft. 6 in., would be used, divided in two by a small shelf on which a small basin is placed, as with the lower one. For the 5th. stage, it is useless to place the boughs in water, as the larvae eat the leaves before they have time to wither and losses due to withering are not to be feared. With this system there is economy of labour, a saving of leaves, and better hygiene, due to the suppression of litter.

The small trestle of Prof. ACQUA gave good results in the hands of private rearers, as well as at the Sericultural Institute of Portici.

Prof. CAMPBELL has introduced a slight modification into the system. The trestle devised by him is about 3ft. long and 1ft. 6 in. high; on the frame

is stretched a cloth which remains till the end of the season, when it is washed and replaced. At the foot of the trestle is the shelf on which is

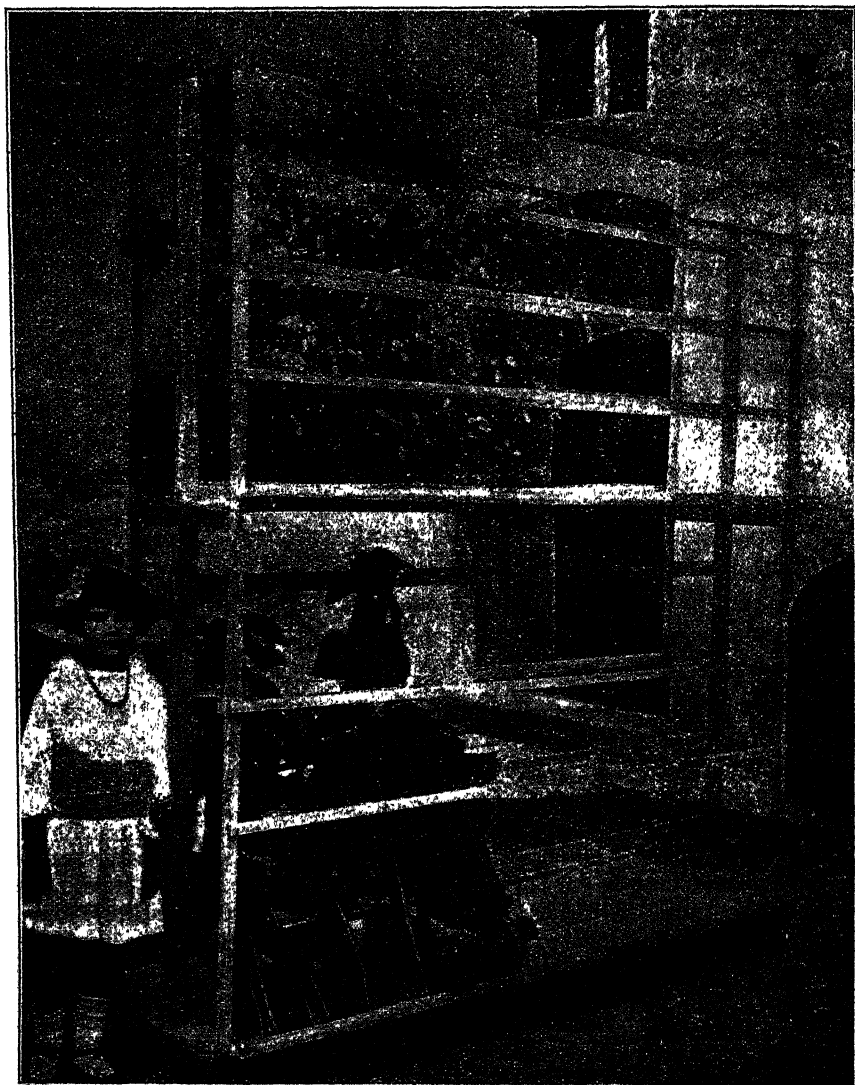


Fig. II — CAMPBELL shelf method.

placed the basin, above which is a board perforated with holes to receive the ends of the mulberry branches ; with this device there is no fear of the larvae falling in the water and drowning, while the water is also protected

from dust. Prof. CAMPBELL is of the opinion that this system should become widely used, especially in southern Italy, where the high temperature and dry climate soon cause the leaves to wither and lose their freshness.

To restrict the space required so as to approximate that necessitated by the Friulian system, Prof. CAMPBELL has devised a system for rearing stages following the first one, and which consists of hurdles or supports (fig. 2) placed one above the other in pairs, 6ft. 6 in long and 3ft. 3 in. apart; the double series together thus being 6ft. 6 high. On each support are small shelves, each 2ft. wide and inclined inwards; the boughs are placed upright on these shelves, their tops being supported obliquely by transverse ledges.

The mulberry branches are placed successively on the shelves according to the development of the larvae, and the length of the branches available. In the 4th. and 5th. stages the branches can be placed up to the third shelves in measure as the branches are gradually stripped. The branches are first placed in one half of the trestle, and when this is quite full and the larvae have eaten all the leaves, the branches are placed in the opposite half well in contact and interlaced with the branches on which are the larvae, so that they can easily pass on to the fresh boughs.

As an alternative, both sides of the trestle may be used by slightly separating the branches on which are the larvae, and placing the fresh branches in the gaps between, when the first are completely eaten. The old branches are removed when the larvae have left them.

The oblique shelves prevent the larvae from falling to the ground or on the lower shelves, and also receive the excreta. At the end of the 5th. stages, the heath is placed in the upper half of the trestle and the larvae move into it of their own accord.

This system gives economy of space and labour, as well as better hygienic conditions due to the good ventilation.

**328 - On Some Cytological Data on the Phenomena of Parthenogenesis in the Silk-worm** (1). — LÉCAILLON, A., in *Comptes rendus des Séances de l'Académie des Sciences* Vol. 166, No. 4, pp. 180-181. Paris, Jan. 28, 1918.

The author gives the results of his investigations into certain fundamental points concerning the changes which taken place in the unfertilised egg.

1) The examination of consecutive sections of eggs which, towards the third day after being laid, began to turn from yellow to pink, showed that the development of the embryo had already reached the stage where the serum, amnios and embryonic sack were formed. and where the breaking up of the vitellus has already taken place. The stage at which colour begins to change is not a starting stage, but corresponds to an already advanced development. The appearance of the pink colour is due to the deposition of pigmented granules in the cells of the serous envelope against the vitelline membrane. This stage is exactly similar in the fertilised egg.

(1) See R. April, 1916, No. 427; Oct. 1917, No. 936; Nov., 1917, No. 1050; Feb., 1918, No. 197.

2) In unfertilised eggs which have not changed colour and have been laid a sufficiently short time for the cellular degeneration to be still visible, an intravitelline segmentation was observed similar to that taking place in the fertilised eggs of most insects, except that more or less premature cessation of development was manifest.

3) In unfertilised eggs which had kept their original yellow colour, but which were from 10 to 12 days old, cellular degeneration was much more marked than in the preceding case.

4) These facts confirm and extend those already given by the author in a preceding note (1), which showed that, in the eggs of *Bombyx mori* which do not change colour, important phenomena of development take place. The capacity for parthenogenesis in the silkworm, therefore, really corresponds to a quality proper to the female reproducing element and not to a property peculiar to eggs which change colour after being laid.

The earliest stages of degeneration observed in *Bombyx mori* which only correspond to a segmentation stopped very early seem in every way comparable to the rudiments of development observed in birds.

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

329 - **The Work of a Tractor in Stony Soil.** — PLUCHET, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 36, pp. 1037-1040. Paris, November 21, 1917.

The author advised the purchase of a 10-20 HP. tractor for a large estate at Eure-et-Loire, France, having a number of stony areas. The tractor was chosen, on the recommendation of M. RINGELMANN, from amongst those tested at Noisy-le-Grand (2).

Paraffin was used as fuel, being so much cheaper than petrol; heavy oils of at least 30° Baumé could also have been used. The tractor began work on uncultivated ground about July 15, 1917. For various reasons, such as bad weather, harvest work, holidays, etc., the tractor only worked 340 hours, or 45 days of 8 hours, from the above mentioned date up till the end of October. During this time 160.6 acres were worked to a depth of 7 to 8 inches (about 1 acre in 2.2 hours), in very stubborn and stony soil. In these soils, the usual implements and tools wear very quickly and the average work done by 1 man with 3 horses does not exceed 4 200 to 4 800 sq. yds. per day.

The 160.6 acres worked cost about £ 110. 3s. for fuel, lubricants, socks and new parts, repairs and upkeep. The working parts of the machine did not seem to have suffered, in spite of the difficult ground. The tractor was driven by the estate foremen; in spite of this, the author allowed the drivers the pay of 9½d. an hour; on adding, for the working hours £ 13. 12s. to the expenses, the total became £ 123. 15s. and each acre worked cost 15s. 5d.

(1) See R. Oct., 1917, No. 936 — (2) See R., November, 1917, No. 1051 and R. January 1918, No. 81. (Ed.)



The author has only been able to estimate very roughly the depreciation of the machine, etc. Supposing that the tractor, which cost £500, can last three years if well cared for, the depreciation would amount to about £13.18s. a month, giving say £48 13s. for the 3 ½ months of work. The total cost for the 160.6 acres would then amount to £172. 8s. or. 21s. per acre, which is very high for work at 7 to 8 inches deep, but little higher than the cost for the same work performed by animals.

This example again shows the advantage of machine cultivation and the great help it may afford under the present circumstances, even with imperfect machinery.

330 - **Cultivation Trials with a Moline Tractor, in Italy.** — TARCHETTI, A., in *Il Giornale di Riscicoltura*, Year VII, No. 22, pp. 278-282. Vercelli, November 30, 1917.

Cultivation trials with the combined Moline tractor (1) were carried out in ricefields, in October and November 1917, by the Machinery Section of the Experimental Rice-growing Station at Vercelli.

The first trials took place at Muleggio (Vercelli) in both ricefields and ordinary ones. The tractor drew a 2-furrow 12 in. plough, to which was fixed, according to the ricegrowers' wishes, an ordinary coulter as well as a skim coulter replacing the circular coulter.

The wheels were provided with 3 rows of cuneiform spikes projecting 4 in. beyond the tyre. In the ricefield the average speed when working at 6 to 7 in. was about 3 miles per hour; in the ordinary field the speed was 2 ½ miles per hour at a depth of 7 to 8 in. and a width of 24 in., which correspond respectively to 3 468 and 2 870 sq. yds. of surface covered per hour. These first trials gave quite satisfactory results.

The next trials were carried out at Castelmerlino (Vercelli) in a well-manured riceland, in good general condition, save one short and difficult strip which was very soft. Instead of spikes, the wheels were fitted with strakes projecting some 5 ins. The author gives the following results obtained one period of the trial: —

Duration of trial: 2 hrs., 4 mins., 20 secs., <i>i.e.</i> . . . . .	7460 seconds
Divided up as follows: —	
Duration of ploughing (average of 3 minutes per furrow of 618 ft. . . . .	3960 "
Duration of turning (average of 30 secs.) by towing . . . . .	660 "
	<hr/>
Total duration of the work. . . . .	4620 "
Optional stoppages for adjustments of plough, measuring, etc. . . . .	2840 "
	<hr/>
Total time. . . . .	7460 "
	<hr/>
Average depth of ploughing . . . . .	7 to 8 in.
Area ploughed: — average furrow length . . . . .	618 ft.
Total furrow width . . . . .	50.15 ft.
Area ploughed during the trial . . . . .	2994.2 sq. yds.
Petrol consumed during the trial 2.42 galls. equal to 16.94 lbs. (density 700)	

(1) See R. 1917, No. 941. (*Ed.*)

The conclusions are:

Petrol consumed (1)	{	per acre	14.3 lb.
		" hour.	8.16 lbs.
Area ploughed per hour . . . . .			2762 sq. yds.

Using these results, the author calculates the cost of mechanical ploughing per day: —

The **MOLINE** tractor with a 2-furrow plough and accessories costs £ 600 in Italy; assuming that the petrol costs 7*d.* a lb. and that a tractor is used on 80 days during the year, the daily cost would be:

Petrol for 10 hours work 88 lbs. at 7 <i>d.</i> a lb. . . . .	51 <i>s.</i> 4 <i>d.</i>
Driver's wages . . . . .	8 <i>s.</i>
Lubricating oil . . . . .	3 <i>s.</i> 2 <i>d.</i>
Interest and depreciation at 5% on £600 and assuming the machine to last 10 years. — say . . . . .	20 <i>s.</i>
Insurance, various expenses . . . . .	6 <i>s.</i> 4 <i>d.</i>
Daily cost . . . . .	88 <i>s.</i> 10 <i>d.</i>
that is, one acre costs 14 <i>s.</i> 9 <i>d.</i>	

The author observes that machine ploughing is fairly costly but under present conditions, given the scarcity of labour and draught animals, it is important to produce as much as possible.

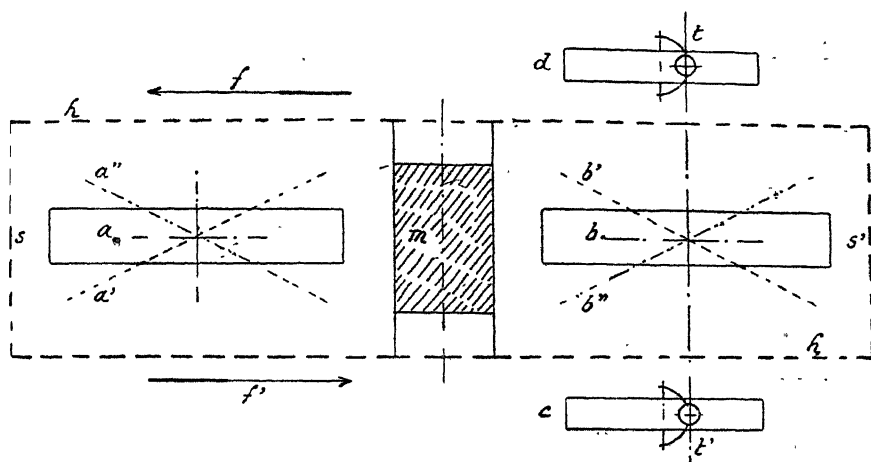
331 — **The Dessaules Tractor.** — **RINGELMANN, MAX**, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVI, Vol. CXXVIII, No. 6, pp. 476—478, fig. 1. Paris, November-December, 1917.

The **DESSAULES** tractor took part in the 1917 trials at Noisy-le-Grand (2), France; the test model was made by **M. H. DESPLAND**, of Levallois-Perret, Seine. The appended schematic figure shows the type of machine, which has 2 driving and steering wheels *a* and *b*, which can turn obliquely in the directions *a'* and *b'* or *a''* and *b''*; these wheels are placed one behind the other, transverse equilibrium being provided for by two pivoting wheels *c* and *d*, mounted on forks, fixed to a beam *tt'* attached to the upper part of the frame, whose plan is shown at *h*. The engine *m*, placed low down between the driving wheels, chain-drives an intermediary shaft just above it; the shaft drives, through 2 chains, two axles placed above the wheels *a* and *b*; the driving-wheels are driven by 2 chains-drives from these axles; the gearing thus includes 5 chains, which should not run at the same speed, as in the experimental model. The driver's seat being placed either at *s* or *s'*, the machine can move either in the direction *f* or *f'* in a turnip-field, without turning on the furrow; the hauling attachment is at *h*, on *s* or *s'*.

(1) The petrol consumption on normal work would be 8 8 lb per hour and 16 lb per acre.

(Author)

(2) See *R.* January, 1918 No. 81. (Ed)



Plan of DESSAULES tractor.

332 - **The Wyles Motor Plough.** — I. *The Agricultural News*, Vol. XVI, No. 406, p. 357. Barbadoes, November 17, 1917. — II. FRIER, VICTOR, in *Le Génie Rural*, Year X, No. 76, (New Series, No. 16), pp. 11-15, figs. 5. Paris, 1917.

According to information received by *The Agricultural News* from the Secretary of the Food Production Department of the Board of Agriculture and Fisheries, England, it would appear that the WYLES motorplough is well suited for work in orchards and on small farms, while being unsuitable for large farms.

This English-made motorplough is guided by handles by a man walking behind; the 2-furrow plough can be lifted so as to clear the headlands, as the weight of the machine is well balanced about the front axle.

All parts of the machine are standardised and can easily be replaced.

The chief points of the WYLES motorplough are as follows:

1 cylinder vertical 11 HP engine.

Gears completely enclosed and working in an oil bath; 2 forward speeds are provided; a reverse is unnecessary.

Wheels — diameter, 2 ft. 9 in.; tyre, 7 in. wide; length, 12 ft. 6 in.; width, 2 ft. 9 in.; height, 4 ft.

Including a 2-furrow plough, it weighs about 20 cwt.

This motorplough, though possibly not very suitable for strong sugar-cane fields, would work very well in light soils, and in cotton fields, etc. It is made by the WYLES MOTOR PLOUGHS CO. LTD., of Manchester.

II. — The WYLES patent, No. 464 699 (1913), described in *Le Génie Rural*, includes a new device for the steering and general control of wheeled agricultural machinery, such as motorploughs, etc. The cultivating implement may be varied as required. The machine is easily steered and becomes quite automatic (provided that the engine has a regulating device); it requires no attention save in turning at the headlands.

Another WYLES patent, No. 477 074 (1914), concerns improvements of a mechanism regulating the wheels which uses the power of the engine, driving the carrying wheel or wheels, to lift the body of the machine automatically.

Designs are given with the patents, showing details of the inventions.

333 - **The Blanchard (1): Double Brabant Windlass Plough.** — RINGELMANN, MAX, in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVI, Vol. CXXVIII, No. 6, pp. 473-476, 4 fig. Paris, November-December, 1917.

The BLANCHARD double-brabant plough is of the windlass-plough type; it carries the engine and 2 reeling drums, on each of which is rolled a cable whose end is anchored in the furrow.

An Ardennes farmer, M. BLANCHARD has invented the machine, the model tried at Noisy-le-Grand, France, having been made by M. E. ALLONGÉ of Paris. Figure 1 shows the general view of the machine, while figure 2 shows its plan. In the latter various details can be seen: — the machinery fixed to the support of a double-brabant plough; the beam *a*; the ploughs *b* and *b'*; the furrow wheel *c* running in the furrow *x*, and the land-wheel *c'* running at *x'*; the grounding screw *d* and the stilts *e* that carry the locking mechanism; the stays turning round the beam *a* fixed to the support *ee'*.

The machinery fixed to 2 bars of the wheels *cc'* includes a small 3-4 HP. single-cylinder engine *A*; the cooling of the cylinder ribs is provided for by a lateral fan; the petrol tank is placed on a shelf supported at *f*. The engine shaft is connected by a chain drive *g* to an intermediary shaft *B*; the windlasses *C* are mounted on a shaft driven by a chain *i* from *B*; in these 2 drives, reducing the engine-speed, the tension of the chains are regulated by rollers *h* and *j*. The 2 windlasses *C* can each be geared up to the shaft on which they are mounted when they pull the plough by rolling up the cable *m*, or put out of gear when the cable *n* is unrolled behind on the untouched strip *x'*. In the machine tested by the author, the cables, when used for traction, pass between guide rollers *l*, which will be replaced in the final model by an automatic winder.

In the trials, the greatest traction could not be more than 770 lbs, equal to the breaking point of the cable. When the plough moves in the direction *r*, it hauls on the cable *m* and pays out the return cable *n* behind. When at the end of the cable, the driver puts the windlass out of gear, removes the cable *m* from the guides *l*, tips and turns the plough so as to place it in position to open the new furrow, fixes the hook of the cable *m* on the anchor chain in the furrow; he then passes the cable *n* between the guide *l* of the second windlass, which he puts in gear, when the plough moves in the opposite direction to *r* to the other headland, when the same process is repeated. The driver walks alongside the machine.

The cables are simply laid down, and are not damaged in any way by rubbing. The anchorage for each cable consists of a chain some 16 ft long,

held down by stakes ; the cable hook engages in one of the links of the chain, and, each time the plough arrives at the headland, the hook is moved along the anchor chain to a width equal to about twice the furrow width.

BLANCHARD *Double brabant windlass plough.*

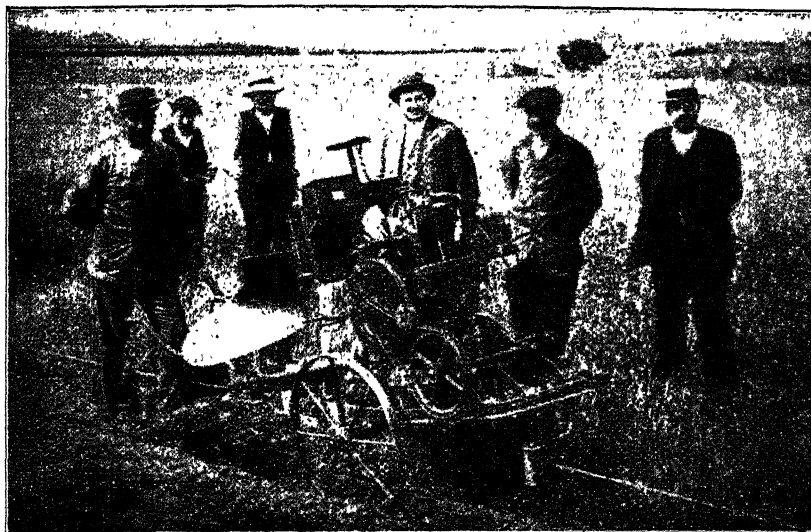


Fig. I — View of the machine.

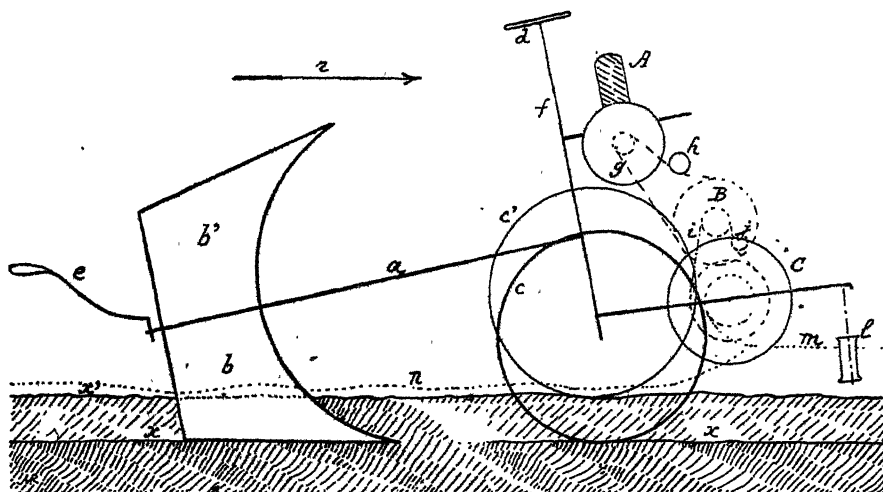


Fig. II. — Diagram of the machine.

334 - **The Shubert Weed and Sprout Destroyer.** — *Farm Implement News*, Vol. XXXV No. 49, pp. 36, 2 figs. Chicago, December 6, 1917.

The extermination of weeds, sprouts, etc., with the usual machines is  
*The Shubert Weed and Plant Destroyer.*

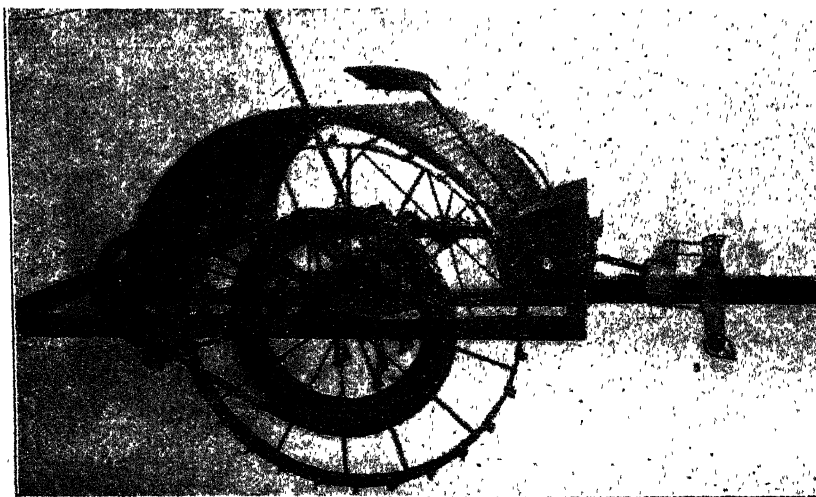


Fig. I. — Side view.

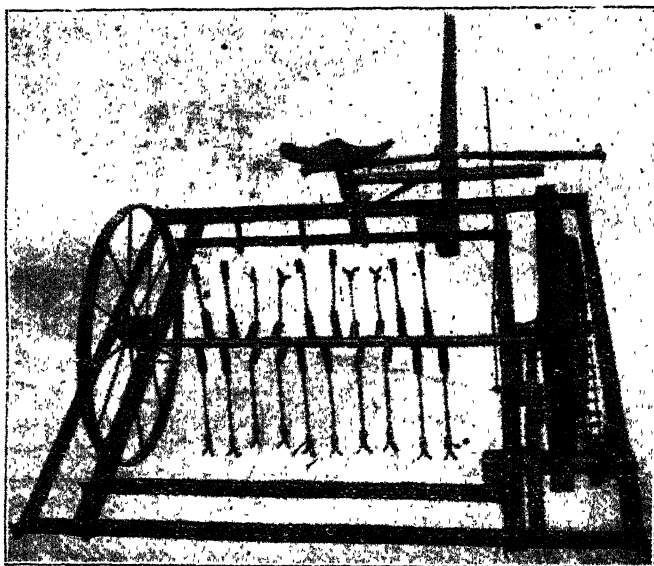


Fig. II. — Rear view.

for that purpose is very difficult and even impossible on stony and stumpy land.

As is shown in the appended figures, the machine is provided with a revolving cross bar to which are attached a number of chains ending in cutting blocks. Power for revolving the chains is derived from one wheel and transmitted by suitable gearing. The chains are whirled at high speed, the velocity being such that any plant struck is reduced to shreds and spread over the ground. Ability to work among stumps and stones is due to the flexibility obtained by using chains, which simply work themselves round obstructions. The cutting ends do not reach the ground, so that grass is left uninjured.

The machine weighs about 850 lbs. ; the wheels are about 4 ft. high and the space within the angle iron frame about 4 ft. square. It is made by the SHUBERT SPROUT MOWER COMPANY of Richland Mo., U. S. A.

335 - **Copra Driers.** — See No. 346 of this *Review*.

336 - **Investigations of Irrigation Pumping Plants, in Montana, U. S. A.** — MURDOCK, H. E., in: I. *University of Montana. Agricultural Experiment Station, Circular No. 60*, pp. 37, fig. 17. Bozeman, Montana, January, 1917; II. *Ibid.*, *Bulletin No. 115*, pp. 127—148. fig. 6, tables 5. Bozeman, Montana, January, 1917.

I. In the United States many irrigation pumping plants have been installed without sufficient forethought and thus have resulted in failure.

In studying the question of installing an irrigation pumping plant, special attention should be paid to well prepared plans, proper types of pumps, cost of plant, maximum head that can be lifted, market conditions and prices of crops to be grown, etc. Crops grown with pumped water should require little water and give high crop value for each acre, while the plant installed should give the maximum running economy with the minimum maintenance charges.

The author considers the various types of pumps ; centrifugal pumps, the horizontal type of which is most adapted for lifting not more than 30 ft., while the vertical type is suited for deeper wells of 3 to 6 ft. diameter ; turbine pumps, for deep wells (250 ft.) of small bore (12 to 30 in.) ; plunger pumps, for deep wells of small bore (3 in.). It should be noted that irrigation from deep wells is very dear, and only pays for high-priced crops. Plunger pumps are of very small capacity thus being most suited to filling reservoirs till enough water is stored for a day's irrigation.

Irrigation pumps can be driven by windmills, steam, gasoline and oil engines of the portable, stationary and tractor types. Windmills have long been used for this purpose ; if well cared for, they last a long time ; they usually drive plunger pumps. Using gasoline for pumping is expensive, and to utilise the cheaper, heavy oils the fuel oil engine has been rapidly perfected. The heavy oil engines have the advantage that with a little adjustment they can use any liquid fuel of a higher grade than that for which they are designed. The operation of a steam engine requires a more skilled mechanic than does an internal combustion machine. The laws of Montana require a licensed engineer to operate a steam engine. There is a

large amount of lignite and soft coal in Montana will could furnish a source of cheap power. Electric motors have many advantages; many plants only require a visit once every 24 hours for oiling and other attention.

Curves are given to help in choosing a pump, use being made of various conditions of speed, head, discharge and power. A few of the most common engine and pump troubles are described as well as methods for remedying them.

As regards the cost of operating pumping plants, the author assumes it as being directly proportional to the lift. For a pumping installation driven by a gasoline motor, the proportional annual cost for the gasoline was 58.7 %, 19.7 % for the irrigator and operator, 15.7 % for interest and depreciation, 5.9 % for lubricating oil; for a plant driven by a paraffin motor the figures were: — 46 % for paraffin, 25.8 % for the irrigator and operator, 20.5 % for interest and depreciation, 7.7 % for lubricating oil; these figures vary very greatly, but can be much reduced by giving as much care to the irrigation as to the pumping plant.

II. The Agricultural Experiment Station of the University of Montana has tested a number of pumps and engines, in order to throw light on the problems of pumping for irrigation. The tests were partly carried out in the University laboratory and partly with plants actually working.

The pumps tested in the laboratory were: CASE plunger pump; FRIEND motor pump; GOULDS Pyramid plunger pump; BYRON JACKSON vertical centrifugal pump; American 7-in. vertical centrifugal pump. The pumps tested in the field were all of the horizontal centrifugal type and were: 1 Morris 18-in.; 1 American 10-in.; 1 GOULDS 8-in., 1 Rumsey 6-in.; and 2 GOULDS 6-in. pumps.

The following engines were used in the laboratory tests: — Case 75 HP. steam tractor; International Harvester Company 45 HP. petrol-paraffin tractor; Case 36 HP. steam roller; Fairbanks-Morse 5 HP. vertical petrol engine; International Harvester Company 5 HP vertical petrol engine; Friend horizontal 4 HP. petrol engine; Int. H. C. I HP, paraffin-engine, Fuller & Johnson 3/4 HP. vertical petrol engine.

The following engines were used in the field: Case 75 HP. stationary steam engine; Fairbanks-Morse 65 HP. stationary steam engine; Fairbanks-Morse 20 HP. horizontal paraffin engine; Galloway 15 HP. horizontal petrol engine; Field 12 HP. horizontal petrol engine; Galloway 8 HP. horizontal petrol engine.

To measure the water discharged, a 2-ft. CIPOLLETTI weir was used. For the field tests a temporary rectangular weir was used when practicable; for smaller currents a current meter was used. In tests for power consumption a PRONY brake was used.

The results of the tests are shown in 5 tables which give: the HP. of the engines, the head of water, discharge, the various types of pump tested, the water lift, consumption of fuel, and the quantity of lubricating oil used.

The results of the laboratory tests bring out forcibly the inadvisability of using any chance combination of power and pump that may be available. They also indicate what kind of combination should be made to secure an efficient plant. Thus if a 45HP tractor is used to drive a 7-in. vertical pump, with a 50-ft lift, the tests show a fuel consumption of about 0.4 gallon per foot acre-foot, which is very satisfactory. The same tractor driving a 5-in. vertical pump consumes 50 % more fuel; with a 3-in. pump there is



a fuel consumption of about 2.5 times the amount required for the largest pump. If the lift is 25 ft., a larger pump than those tested should be used with such a tractor, for the fuel consumption would be about 50 % greater than that for the 50-ft. lift.

To lift 10 feet, the tractor with the largest pump consumed 1.22 gallons of fuel per acre-foot. With a much larger pump designed for a low lift, less fuel would have been consumed. In tests with a 5HP. engine, driving a 3-in. and 5-in. pump respectively, the fuel consumption was about 0.7 gallon per foot acre-foot.

These results indicate the necessity for careful designing of pumping plants and proper operation of the plant after it is installed.

### 337 - Review of Patents.

#### *Tillage Machines and Implements.*

France	485 428	Plough.
Switzerland	76 642	Tilling machine.
United Kingdom	110 729	Motor-cultivator.
	111 264	Motorplough.
United States	1 246 388	Cylinder harrow.
	1 246 462	Centre pressure device for disk harrow.
	1 246 851	Plough.
	1 246 916	Harrow tooth holder.
	1 247 018 — 1 248 517 — 1 249 178	Stalk cutters for maize.
	1 247 043 — 1 249 450	Harrow.
	1 247 170	Motorplough tractor.
	1 247 762	Tool shifting mechanism for agricultural implements.
	1 248 034	Agricultural implement.
	1 248 194	Cultivator.
	1 248 257	Revolving harrow.
	1 248 945	Land roller.
	1 249 103	Attachment for stalk cutter.
	1 249 395	Self cleaning harrow.
	1 249 447	Tractor plough.
	1 249 523	Two-way motorplough.
	1 249 524	Reversible tractor plough.
	1 249 555	Combined harrow and cleaner.
	1 250 013	Gang plough.

#### *Irrigation.*

British India	3 201	Gravity water elevator.
Canada	179 444	Ditch plough.
United States	1 248 271	Regulator plough.

#### *Manures and Manure Distributors.*

France	485 455	Ammonia produced by catalysis for making simple and complete manures.
United Kingdom	111 254	Method of treating the soil to improve its productivity by means of spraying water heated at 180-210° F.
United States	1 247 001	Attachment for lime spreader.
	1 247 631 — 1 247 703	Manure spreaders.

- 1 247 632 Wide spread attachment for manure spreader.  
 1 248 032 Spreader for fertilizer distributor.  
 1 248 303 Straw spreader.

*Drills and Seeding Machines.*

- Denmark 22 475 Potato planter.  
 United States 1 247 007 Anchor for check row planters.  
 1 247 075 Clutch for maize planter.  
 1 247 738 Planting mechanism.  
 1 247 744 Combined disk lister and planter.  
 1 247 763 — 1 248 351 Seed planters.  
 1 248 717 Maize planter.  
 1 249 067 Lister plough.

*Various Cultural Operations.*

- United States 1 246 896 — 1 247 764 Cultivators.  
 1 247 246 — 1 248 160 Cotton choppers.  
 1 248 010 — 1 249 569 Weeding ploughs.  
 1 248 231 Riding cultivator.  
 1 248 365 Machine for pulling cotton plants.  
 1 248 706 Vineyard disk plough or cultivator.  
 1 248 914 Hand cultivator.

*Control of Diseases and Pests of Plants.*

- France 485 274 Improvements in powdering machines.  
 Switzerland 76 646 Trap for rats, mice.  
 United Kingdom 111 044 Device for destroying insects.  
 111 142 Vermin proof room for preserving fruits.  
 United States 1 248 751 Grass and weed cutter.  
 1 249 988 Potato bug killer.

*Reapers, Mowers and Harvesting Machines.*

- British India 3 171 Improvements in or relating to instruments for tapping.  
 India rubber producing and like latex yielding plants.  
 Canada 179 060 Sheaf carrier.  
 179 090 Grain binder.  
 179 277 Sheaf shocker.  
 179 297 Harvester mechanism.  
 Switzerland 76 644 Cherry picker.  
 United Kingdom 111 052 Reaping and mowing machine.  
 United States 1 246 234 Gang lawn mower.  
 1 246 951 — 1 246 963 — 1 247 005 — 1 247 943 — 1 249 935 Shocking  
 machines.  
 1 247 070 — 1 249 914 Harvesters.  
 1 247 387 Cotton picking machine.  
 1 248 591 Corn husking machine.  
 1 249 295 Seed gathering attachment for mowers.  
 1 249 445 Peanut harvester.

*Machines for Lifting Root Crops*

- Denmark 22 464 Tool for topping and lifting turnips by hand.  
 22 560 Combined potato digger and elevator  
 22 616 Turnip topping and lifting machine

- United States    1 246 811 Beet harvester.  
                     1 247 813 Potato digger.  
                     1 248 330 Beet topping machine.  
                     1 248 379 Beet digger.  
                     1 249 911 Frame for beet harvesting machine.

*Threshing and Winnowing Machines.*

- Canada            179 093 Grain cleaner.  
                     179 105 Grain grader and cleaner.  
  United States    1 246 949 Grain saving device for threshing machines.  
                     1 249 663 Feeder for grain separators.  
                     1 249 966 Grain separator.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- British India     3 178 Rice huller.  
  Denmark         22 476 Straw binder.  
                     22 568 Combined straw gatherer and binder.  
  United Kingdom   110 556 — 111 307 Baling presses.  
  United States    1 246 569 — 1 246 759 — 1 248 753 — 1 249 505 Hay presses.  
                     1 246 994 Stacker.  
                     1 247 233 Hay gathering and baling machine.

*Steering and Traction of Agricultural Machinery.*

- Canada            179 228 Wagon mechanism.  
  United Kingdom   111 242 Caterpillar tractor.  
  United States    1 246 443 Tractor wheel.  
                     1 246 603 — 1 249 996 Tractors.  
                     1 246 777 Whiffle tree.  
                     1 247 073 Traction machine.  
                     1 248 036 Tong truck.  
                     1 248 599 Steering device for tractors.  
                     1 248 693 — 1 249 059 Farm tractors.  
                     1 249 166 Caterpillar tractor track.  
                     1 249 424 Draft connection for tractor.

*Feeding and Housing of Livestock.*

- United Kingdom   110 853 — 111 214 Horse shoes.  
  United States    1 246 751 Collapsible hog feeder.

*Poultry Farming.*

- Switzerland       76 645 Transportable poultry house.  
  United Kingdom   111 208 Incubator.

*Bee Keeping.*

- United Kingdom   110 834 Device for uncapping honey combs.

*Industries Depending on Plant Products.*

- British India     3 130 Improved method for preparing potato meal.  
                     3 133 Improved sugar cane grinding mill.  
  Switzerland       76 680 Grinding machine and plates.  
                     76 892 Fruit and vegetable dividing machine.

*Dairying.*

Canada	179 217	Cream separator for milk bottles.
	179 270	Bearing for milk separators.
Denmark	22 488	Apparatus for warming or cooling milk by regeneration.
	22 625	Driving mechanism for milk pasteurising apparatus.
Switzerland	76 936	Churn.
United Kingdom	110 621	Cheese (curdling of milk).
	111 341	Process for preparing milk powder.
United States	1 246 292	Teat cup for milking machine.
	1 249 345	Milking machine.

*Farm Buildings and Equipment.*

United States	1 246 281	Silo.
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*Various.*

British India	3 207	Single or double suction foot pump.
United Kingdom	110 641	Centrifugal pump.
	110 851	Wind motor.

## RURAL ECONOMICS.

338 - **Size of Farm Business.** — JOHNSON, O. R. and FOARD, W. E., in *University of Missouri College of Agriculture, Agricultural Experiment Station Bulletin* No. 140, pp. 1-40. Columbia, Missouri, April, 1917.

This study of the size of farm business was made by means of a Farm Management Survey in the Western part of Johnson County, Missouri.

The farm management method of securing data includes the obtaining of estimates of all receipts and expenses on each farm in a district or region, for a year, and the investment at the beginning and close of the year. Data are secured concerning methods, practices and social conditions of the region. The incomes of all farms are then ascertained and certain factors which have to do with the success of the business are calculated. Then the farms are grouped according to size, capital, labour income and other factors.

*The Region Studied.* — The region selected for this study which includes four townships in the western part of Johnson County, is typical of a large section of the State. The soil, climate, railways, roads, markets, land values, size of farm, and type of farming are similar to those found in many sections of central Missouri. The average crop yields for the region in 1912 were: maize, 35.4 bushels per acre; wheat, 17.8; oats, 28; hay, 1 ton. The average price of maize, was 45 cents, wheat 85 cents, oats 35 cents and hay \$ 12.

*Size of farms, their percentage distribution and proportion of tillable land.* — The farms used were first divided according to number of acres operated, the percentage of tillable and pasture land, and of waste land as shown in Table I. This gives a general idea of the distribution of the farms in the size groups. The average size of the farms of the region was 137.8 acres.

TABLE I. — *Percentage distribution of farms by size and proportion of tillable land.*

Size group acres	Farms	% of total	Tillable land %	Pasture land %	Waste %
< 40 . . . . .	47	7.0	82.2	26.1	6.0
41- 80 . . . . .	149	22.3	86.9	32.1	5.6
81-120 . . . . .	151	22.6	80.5	31.3	5.0
121-200 . . . . .	191	28.6	86.4	33.5	3.5
201-400 . . . . .	106	15.9	81.5	37.5	3.2
> 400 . . . . .	24	3.6	87.4	47.1	2.7
Total . . . . .	668	100.0			

The distribution of investment in the various groups is shown in Table II. The proportion of investment in real estate increases on the larger farms. Under present conditions the market value of land is gradually increasing but the man on the small farm gets less benefit from this increase in value than the man on a large farm, because a smaller percentage of this total capital is invested in real estate.

TABLE II. — *Distribution of Investment on 668 Farms.*

Size group	Farms	Real estate	Machinery	Live stock	Supplies	Cash	Total
< 40 . . . . .	47	76.6 %	3.3 %	16.9 %	2.2 %	1.0 %	100
41- 80 . . . . .	149	78.9	2.5	15.5	2.0	1.1	100
81-120 . . . . .	151	81.8	2.2	13.5	1.7	0.8	100
121-200 . . . . .	191	81.3	2.2	13.7	2.2	0.6	100
201-400 . . . . .	106	83.2	1.9	12.3	1.8	0.8	100
> 400 . . . . .	24	83.6	1.6	11.9	1.7	1.2	100

Table III gives the number of various classes of livestock, horses, cows, brood sows, and total animal units (1), on the farms of different sizes, the crop acres per animal unit and the efficiency with which the farmer uses his own labour and equipment on the various sized farms. The operator of a small farm grows 15.9 acres of crops for each workman, 7.3 crop acres for each work horse and 20.9 crop acres for each hundred dollars invested in farm machinery. Against this the 201-400 acre farmer grows 67 acres of crops for each workman, nearly 17 acres for each horse and 35 acres for each 100 dollars worth of machinery. The workman has multiplied his

(1) **DEFINITION OF TERMS.** An *Animal unit* is a horse, cow, five mature hogs, or seven mature sheep; two young animals are regarded as equal to one mature animal of the same kind, on the basis of feed and manure produced. This unit is only approximate at best.

A *productive work unit* is a 10 hour day of productive work, done by either a man or a horse. It includes work on live stock, on farm crops, or on the improvement of land; but not on work stock, on the repairs of fences, buildings, and machinery; or on anything else included in the maintenance of the farm.

A *crop index* of 97 simply means that the yield per acre of all crops on this farm or group of farms is 97 % as great as the average yield of the groups of the region.

*Labour income* is the farmer's net return after paying from his gross income all general running expenses, including also interest at 5 per cent, depreciation, and wages for hired labour and members of his family, but excluding household expenses. (*Ed.*)

efforts by four, the work horse has doubled the amount of work which he does, and the cost of using equipment has been reduced by nearly half. This will explain in part some of the results which will be given later.

TABLE III. — *Animal Units, Labour Equipment and Size of Farms.*

Size group	Horses	Cows	Sows	Total animal units	Crop acres per		Average size acres	Crop acres per		
					animal unit	animal unit, except horses		Man	Horse	\$ 100 equipment
< 40 . . . . .	2.3	2.8	1.0	4.8	3.48	6.68	26.6	15.9	7.3	20.9
41-80 . . . . .	3.5	2.4	1.8	10.6	3.29	4.13	64.6	25.9	8.4	22.0
81-120 . . . . .	4.2	3.0	3.8	13.4	4.47	6.52	103.3	49.2	14.3	33.0
121-200 . . . . .	5.8	4.6	3.1	21.0	4.20	5.81	159.2	58.9	15.3	33.1
201-400 . . . . .	8.0	6.6	5.7	31.8	4.25	5.68	243.5	67.7	16.9	35.1
> 400 . . . . .	10.4	14.9	10.5	53.8	3.88	4.84	459.6	77.2	21.2	35.6

The same general condition is shown in Table IV, giving the number of productive work units (1) per man and horse on farms of various sizes. This table shows that the man on the smallest farm does about a third as much work as the man on the farm of the next size, while the horse on the larger farm does one and a half times as much as the horse on the smallest farm. The labour income varies in the same direction.

TABLE IV. — *Productive Work Units and the Size of Farms.*

Size group	Average size acres	Work units		Labour income
		per man	per horse	
< 40 . . . . .	26.6	65.4	32.0	\$ 146
41-80 . . . . .	64.6	110.3	31.0	227
81-120 . . . . .	103.3	148.7	43.5	313
121-200 . . . . .	159.2	167.1	44.3	525
201-400 . . . . .	243.5	213.0	48.2	711
> 400 . . . . .	459.6	171.5	48.8	999

In Table V it will be found that the receipts per acre decrease as the farm increases in size up to the 120 acre farms, above that there is practically no variation. The farmer on 64 acres has about as much expense and about the same receipts per acre as the man on the 240 acre farm. This gives them about the same net income per acre. When this net income is multiplied by the number of acres operated, it is understood why the large farmer gets the larger labour income.

In comparing crops yields it is found that except for the 26.6 acre farm the yields gradually increase as the size of farm increases. This is shown in Table VI, the crop index (1) being the average yield of all crops in terms of per cent; the average yield of four of the more important crops is higher on the larger farms.

(1) See notes page 381.

TABLE V. — *Size of farm and Receipts and Expenses per Acre.*

Size of group	Receipts		Expenses		Net income per acre
	per farm	per acre	per farm	per acre	
< 40 . . . . .	\$ 463	\$ 17.40	\$ 195	\$ 7.30	\$ 10.10
41- 80 . . . . .	905	14.00	410	6.30	7.70
81-120 . . . . .	1 177	11.40	465	4.50	6.90
121-200 . . . . .	2 124	13.30	980	6.10	7.20
201-400 . . . . .	3 224	13.30	1 480	6.10	7.20
> 400 . . . . .	6 216	13.60	3 270	7.10	6.50

TABLE VI. — *Crop Yields and Size of Farms*

Size of group	Farms	Average size acres	Labour income \$	Crop index %	Corn, bushels per acre	Wheat, bushels per acre	Oats, bushels per acre	Hay, tons per acre
< 40 . . . . .	47	26.6	146	100.74	32.8	16.9	0.0	1.2
40- 80 . . . . .	149	64.7	227	92.3	31.9	18.2	25.4	1.15
81-120 . . . . .	151	103.3	313	93.9	34.1	16.2	25.7	0.98
121-200 . . . . .	191	159.2	525	101.2	36.3	16.5	25.8	1.14
201-400 . . . . .	106	243.5	711	102.5	36.8	17.5	31.6	1.05
> 400 . . . . .	24	459.6	999	110.4	38.0	21.9	34.9	1.06

TABLE VII. — *Income and Size of Farms.*

	< 40 acres \$	41-80 acres \$	81-120 acres \$	121-200 acres \$	201-400 acres \$	> 400 acres \$
<i>Capital:</i>						
Land . . . . .	1 872	4 230	6 520	10 068	17 192	32 561
Machinery . . . . .	80	133	176	266	387	586
Livestock . . . . .	414	830	1 079	1 687	2 525	4 618
Supplies . . . . .	56	108	139	257	380	682
Cash . . . . .	25	61	68	112	175	491
Total capital . . . . .	2 247	5 362	7 982	12 390	20 659	38 939
<i>Receipts</i>						
Crops . . . . .	51	118	188	357	680	1 289
Stock . . . . .	132	306	390	870	1 214	3 161
Stock products . . . . .	60	103	122	181	183	161
Miscellaneous . . . . .	119	149	164	296	443	490
Increased inventory . . . . .	101	226	313	420	704	1 115
Total receipts . . . . .	463	905	1 177	2 124	3 224	6 216
<i>Expense</i>						
General . . . . .	131	282	331	623	1 040	1 781
Stock . . . . .	45	80	92	277	376	1 337
Decreased inventory . . . . .	19	48	34	80	64	152
Total expense . . . . .	195	410	465	980	1 480	3 270
Farm income . . . . .	268	495	712	1 144	1 744	2 946
Interest on invest- ment . . . . .	122	268	399	619	1 033	1 947
Labour income . . . . .	146	227	313	525	711	999

The results shown in the foregoing tables must lead to the conclusion shown in Table VII, giving the capital, receipts, expenses, and labour income

of the various groups. The farmer on the 26 acre farm has only \$ 2447 capital and gets a farm income of \$ 268. The farmer on the next group has \$ 5362 capital and gets a farm income of \$ 495. The farm incomes gradually increase until the larger farm is reached where the farm income is almost \$ 3000, giving a labour income of approximately \$ 1000.

Table VIII shows in a different way the relative profitableness of labour put in on live stock and also on cash crops, on the various sized farms.

TABLE VIII. -- *Returns per Days' Work on Crops and Stock Sold.*

Size of farm	Work done		Crop receipts		Net stock receipts	
	Crops Days	Stock Days	Total \$	Per day \$	Total \$	Per day \$
< 40 . . . . .	9.90	99.70	38.90	3.93	140	1.41
41- 80 . . . . .	23.50	159.40	109.80	4.67	323	2.03
81-120 . . . . .	38.27	244.93	171.00	4.49	505	2.06
121-200 . . . . .	65.82	312.18	326.00	4.96	812	2.65
201-400 . . . . .	128.70	458.65	733.00	5.70	1 056	2.30
> 400 . . . . .	177.90	539.70	1 278.00	7.18	3 228	4.13

The table in general shows a gradual increase in wages per day's work from the small to the large one. In preparing this table, all labour on crops sold was charged to crops, and all labour that was put in crops that were fed was charged to the live stock, after the labour of growing crops for work stock and the crops fed work stock was taken out of the total.

In general it shows that the farmer received half the wage in handling live stock that he received for growing cash crops. This does not mean, however, that he should devote all his efforts to growing cash crops, but lends emphasis to the fact that while a cash crop is often more profitable than a crop fed to live stock, when figured in terms of daily wages, yet the live stock enterprises will furnish labour throughout a much greater portion of the year, thus making the total wage at the close of the year much larger. A man is kept busy with his live stock during rainy weather and all winter when cash crops will furnish no labour at all. It can readily be seen from this table, however, that it will probably give him a more desirable system to have some cash crops in combination with live stock enterprises.

Table IX gives the net receipts from crops and stock and their percentage distribution between the various crops and various classes of stock.

TABLE IX.

Size of farm	Farms	Net receipts from		Percentage from crops	Corn	Wheat	Oats	Hay	Cattle	Hogs	Sheep	Poultry
		Crops	Stock									
		\$	\$	%	%	%	%	%	%	%	%	%
< 40 . . . . .	47	82	174	32.0	74.5	25.5	0.0	0.0	31.6	33.6	0.0	34.8
41- 80 . . . . .	149	187	393	32.3	39.1	52.4	3.0	5.5	29.0	42.6	3.0	25.4
81-120 . . . . .	151	284	561	33.7	31.6	62.0	1.6	4.8	29.0	49.0	2.0	20.0
121-200 . . . . .	191	461	912	33.5	17.8	74.8	2.3	5.2	37.3	45.6	2.3	14.8
201-400 . . . . .	106	903	1 285	41.3	16.0	77.8	0.6	5.6	32.3	53.0	5.3	9.4
> 400 . . . . .	24	1 386	2 610	34.7	8.5	74.0	1.5	16.0	40.2	50.8	3.0	6.0



As the size of farm increases, the importance of corn as a money crop decreases and the importance of wheat and hay increases. In general as the size of farm increases the importance of cattle and hogs increases also, but the receipts from hogs increase more rapidly than the returns from cattle. In the first three groups, the returns from cattle are in the form of dairy products almost entirely, while on the larger farms the returns are often in the form of beef, dairy products being of less importance. Considering the social side of the farm business, on various-sized farms, some interesting facts were brought out. The family living on the small farm costs about \$ 62 per person, while on the large farm \$ 104 a person is spent. The large farmer spends more than four times as much for religious purposes as does the small farmer. The relative importance of cash expenses, produce, and other expenses of family living does not differ widely on the small and the large farm. Of the family living expense, 57 per cent. is a cash item; about 40 per cent. is produce furnished by the farm and the remainder is miscellaneous expenses.

After this discussion of the farm business measured by the number of acres farmed, the writers turn to the study of the influence of various amounts of capital invested on the labour income in the various groups. The following facts were brought out from this study. The labour income, on a certain sized farm, is limited by the capital investment. Some farms are too heavily capitalized and others do not have enough capital invested. The most successful farms in each group have an investment of from \$ 70 to \$ 95 per acre. The farmer with a low capital investment (\$ 54 per acre) sells more crops (50.3 % of receipts from crops) and gets lower yields (94.3 % crop index) than either of the other classes. The man with too high an investment per acre (\$ 148 per acre) does not sell enough crops (73.3% of receipts from crops), nor are his yields high enough to warrant his excessive investment (106.3 crop index); consequently his labour income is low. The man with a low capital investment per acre, does not keep much livestock and gives most of his time to crops. The man with a high capital investment per acre, is fairly heavily stocked and gives only about half his time to crops. The farmer who is making the best income gives about 60 per cent. of his time and about 94 per cent. of his horses' time to the production of crops.

The man with a low capital investment per acre, is giving so much attention to grain farming that his system does not give him enough productive labour. Where the capital is larger, the farmer is able to keep more livestock and thus secure more regular employment. This influences his labour income to quite an extent.

The work horse works harder on the farm with less capital per acre, but this difference in the amount of work which the horse does, does not offset the other advantages of the diversified or stock farming system, which the man with more capital is able to practice on a given area.

Considering the value of land it was found that the value per acre of land does not vary uniformly with the productivity of the soil. The yields increase as the value per acre increases up to \$ 60 to \$ 80 land. Above this

point the increase in yield in much less rapid than the increase in market value. The labour income reaches its highest point on the \$60 to \$80 land. After that the income begins to fall.

The profitableness of a certain farm is also influenced by the amount of productive labour done. It is easily possible for a 160-acre farm to support no larger business than an 80-acre farm. A system which furnishes from 2 to 2.3 days productive man labour per acre pays the largest labour income.

The profitableness of a certain-sized farm is also effected by crop yields. The labour income on a farm increases uniformly as the crop yield increases.

**339 - Government Lands, Leased Lands and Alienated Lands in Australia.** — *The Pastoral Review*, Vol. XXVII, No. 12, pp. 1137. Melbourne, December 15, 1917.

According to official returns there were to the end of June, 1916, in Australia, 105 422 000 acres of land belonging to private owners, while a further 56 096 000 acres were in process of being sold by the Government to private owners.

Then there were 893 054 000 acres leased, or held under various forms of tenure, and 849 159 000 acres of vacant Government lands, including roads and reserves. The position in each State is as follows: —

	Fully Alienated. Acres	Alienation Proceeding. Acres	Leased. Acres	Unoccupied. Acres
1 New South Wales . . . . .	40 363 316	19 409 656	118 865 868	19 415 580
2 Victoria . . . . .	24 256 222	8 075 653	13 035 612	10 878 273
3 Queensland . . . . .	16 447 382	10 776 793	332 824 905	69 070 920
4 South Australia . . . . .	10 590 756	2 943 395	115 396 433	114 314 216
5 West Australia . . . . .	8 125 629	13 584 076	196 772 098	406 106 997
6 Tasmania . . . . .	5 125 197	1 225 924	1 939 905	8 486 574
7 North Territory . . . . .	474 590	—	113 926 627	220 715 583
8 Fed. Territory . . . . .	38 961	80 979	292 690	171 030
Australia . . . . .	105 422 053	56 096 476	893 054 138	849 159 173

**340 - Machine Sheep-Shearing and Lack of Labour in New Zealand.** — BRUCE, J. L., in *The Journal of Agriculture, New Zealand Department of Agriculture, Industries and Commerce*, Vol. XV, No. 3, pp. 134-135. Wellington, September 20, 1917.

Most of the New Zealand owners of sheep realise the advantages of the mechanical shearer, which permits shearing to be carried out more rapidly and more perfectly. Under present conditions it is becoming more and more difficult to find good shearers, and it is especially the small owners who meet with the greatest difficulties. The problem to be solved is whether it is advantageous for each herd owner to possess a mechanical shearer. The co-operation of small owners for the use of one mechanical shearer, as has been advocated, though perfect in theory, is not easy in practice. Each owner of at least 200 sheep should have his own mechanical shearer. Such an apparatus, with a 1 ½ HP motor costs £ 110 (motor, £ 50, plant £ 60). As the use of a machine allows, at the first shearing, a wool surplus which the author estimates at £ 10, and as the value of wool is now 55 % higher than it was in 1913-1914, a yield of from 8 lb. to 9 lb.

would pay half the cost of installing the machinery from the first season. A larger motor, preferably of 4 HP, would be more satisfactory, even for a small herd, for besides shearing, it could also be used for working a chaff-cutter, a pump, etc.

The reduction of labour is of the utmost importance in the present crisis, and in New Zealand, which is essentially agricultural, mechanical shearing is sure to play an important part.

## AGRICULTURAL INDUSTRIES.

341 - The Autolysis of Yeast and the Influence of Its Products of Proteolysis on the Development of Yeast and Lactic Bacteria. — VANSTEENBERGE, P., in the *Annales de l'Institut Pasteur*, Vol. XXXI, No. 12, pp. 601-630, Tables VII. Paris, December, 1917.

Experiments made by the author at the Microbiological Laboratory of the Higher Technical School of Delft (Holland), using: — 1) pressed beer and distillers' yeast; 2) various lactic ferments. The following results were obtained:—

After the death of the yeast cell, it loses its water, becoming much smaller. When the dead yeast has retained its fermentative, especially its proteolytic, activity, the yeast "liquefies", after a time varying with the temperature. The optimum temperature for the endotryptase is from 45-50° C. and the maximum at 53° C. The optimum for autolysis of the living yeast tested was from 48-50° C.

The increased acidity to litmus or phenolphthalein up to a certain fixed degree and the crystallisation of the tyrosine may be taken to show the good progress and end of the autolysis.

Yeast water, obtained by boiling fresh yeast in water, only contains  $\frac{1}{3}$  of the total nitrogen of the yeast. A preliminary autolysis for 23 hours at 48 to 49° C., changes all the nitrogen into soluble nitrogen not coagulable by heat. Autolysed yeast water is a better food for yeast and lactic bacteria than yeast water obtained by simply boiling. Apart from the quantity, the quality of the nitrogen is greatly improved by autolysis.

In autolysed yeast water of the strength of 20 gm. of yeast to 100 cc. of water, there are products that are unfavourable to the growth of the yeast; this harmful influence is removed on dilution.

Amongst substances acting in this way, tyrosine and leucine may be considered as two of the chief products of autolysis.

Leucine is still favourable at the strength of 0.08 gm. %, but completely stops development at 0.66 gm. %. Tyrosine is favourable up to 0.05 %, but beyond that strength is harmful. Asparagine as harmful beyond 1 %.

These products, though harmful to yeast at the strength at which they occur in autolysed yeast water, have no unfavourable influence on the lactic ferments even at the same strength.

The value of autolysed yeast water is due to a mixture of proteolytic products, the chief of which is peptone, and where small quantities of a series of substances, including leucine, asparagine and tyrosine, favour,

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PRODUCTS

independently of the yeast, the growth of the yeast and of the lactic bacteria.

The value of extract of malt is probably due to the presence of a series of proteolytic products similar to those in autolysed yeast (1).

**342 - The Milling and Baking Qualities of Australian Wheat.** — SCOTT, P. RANKIN and WINSLOW, F. G. B., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XV, Pt. 8, pp. 474-481, 1 diagr., 3 figs. Melbourne, August, 1917.

Wheat growing is one of the most important industries of Australia. New South Wales, South Australia, Western Australia and Victoria produce about  $4\frac{1}{2}$  times their own requirement in wheat. In order to control the wheat exported each year the Corn Section of the Chambers of Commerce of the four above-mentioned states fixes a standard of quality, called "fair average quality" or "F. A. Q. standard" which is representative of the quality of wheat produced each year. The standards fixed correspond to the quantity available, an average of 135 000 000 bushels, the yield from the separate States being: — Victoria, 50 000 000 bushels, South Australia, 40 000 000 bushels, New South Wales, 31 500 000 bushels, and Western Australia, 13 500 000 bushels (These totals do not include the quantities set aside for sowing and the feeding of poultry). The amount estimated for home consumption is 30 000 000 bushels, leaving, in normal years, 105 000 000 bushels for export, either as grain or as flour.

In order to ascertain the variations in quality due to climatic conditions during the period of growth experiments were carried out: — 1) to determine the amount of impurities and the proportion in which the various ingredients are present; 2) to classify the wheat according to size and determine the proportion of the various ingredients of each size; 3) to determine the unit weight per volume of original wheat and cleaned wheat; 4) the milling capacity; 5) to determine the gluten content, strength and colour of the flour; 6) its baking qualities.

The chief results are given in the appended tables. Table I shows that in one year, about 24 000 tons of impurities are exported mixed with the original wheat; if only cleaned wheat were exported the cost of shipping would be proportionately reduced; moreover, this quantity could be advantageously used in Australia for feeding cattle. The average percentages of impurities found in the wheats analysed during the four years 1912-13 to 1916-17 were: — New South Wales, 0.52; South Australia, 1.03, Western Australia, 0.59; Victoria, 1.01.

The measurements of the grain given in Table II are of importance in milling, where large, well-developed grain is preferred, as, the more uniform it is, the better does it mill. For most varieties, the larger the grain, the higher is the yield in flour. This does not always apply to a composite sample, as the bran layer is thicker in some varieties than in others. It would be very advantageous to sift the grain before exporting it, so as to

(1) As regards the use of artificial cultures of yeasts for making forage albumen, see *B*, November, 1915, No. 1201. (Ed.)

remove broken or shrivelled grain, the quantity of which was estimated at 12 408 tons, or 4.35 % of the yield, in 1916-17.

The results of the milling tests, given in Table III, show that the amount of water required to condition the wheat was greater than usual, the duration of the operation rather less. The wheats of South and Western Australia gave a high percentage of flour, those of New South Wales and Victoria, a low one. The colour of the flour of all the states was much below the average. None of these wheats can be considered of first quality as regards gluten content or water absorption capacity.

TABLE I. — *Amount (in grams) of foreign matter and unthreshed heads in Australian Wheat (1.000 grams taken).*

State	Barley	Chaff	Drake	Oats	Rubbish	Smut	Stem	Whiteheads	Wild Oats	Wild Seeds	Per cent.	Unthreshed heads per cent.
New South Wales .	0.48	1.52	0.05	0.56	0.52	0.12	0.07	0.19	0.48	0.14	0.413	2.04
South Australia .	2.41	1.47	2.34	0.36	0.84	0.79	0.38	0.38	0.14	0.14	0.925	0.62
Western Australia	2.67	1.73	1.46	0.31	0.34	0.09	0.06	1.29	0.06	0.04	0.805	0.40
Victoria . . . . .	1.79	2.98	2.23	1.84	0.48	0.22	0.28	0.61	0.33	0.27	1.103	1.59

TABLE II. — *Amount of grain (in grams retained on sieves of varying mesh (1000 grams taken).*

State	Size of mesh						Screenings under 2.00
	3.25	3.00	2.75	2.50	2.25	2.00	
New South Wales . .	9.5	75.5	122.5	407.0	224.0	107.0	54.0
South Australia . . .	13.5	263.5	280.5	333.0	65.5	14.0	30.0
Western Australia . .	5.0	198.5	325.5	358.5	74.0	17.5	21.0
Victoria . . . . .	4.0	162.0	199.0	442.5	118.5	45.5	28.0

TABLE III. — *Results of milling tests of F. A. Q. samples 1916-1917.*

State	Cleaned wheat Bushel weight lbs.	Dirty wheat Bushel weight lbs.	Break flour per cent.	Flour per cent.	Bran per cent.	Pollard per cent.	Colour 20 points max.	Strength quart water 200 lbs. flour	Wet gluten per cent.	Dry gluten per cent.	Moisture content Wheat per cent.	Moisture content Flour per cent.
Victoria . . . . .	64.7	60.25	7.5	69.2	17.2	12.6	15.5	17.0	19.25	7.11	11.70	13.06
South Australia . .	64.9	62.00	6.4	73.7	16.3	10.0	15.5	47.6	19.66	6.70	11.34	13.07
New South Wales .	60.9	56.75	5.4	68.6	21.0	10.4	14.5	44.3	18.82	7.00	11.53	13.06
Western Australia	67.1	62.75	3.6	74.9	17.4	7.7	17.0	49.9	22.9	8.01	10.38	12.30

The advantages to Australia of exporting flour instead of wheat are pointed out; they are a saving of  $\frac{1}{3}$  of the tonnage, the home use of the residue and by-products, the encouragement of the national industry.

343 - **The Soluble Nitrogenous Matter as an Index of the Baking Quality of Flour.** —

ROUSSEAU and SIROT, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 4, pp. 190-192. Paris, January 28, 1918.

In 1913 the authors showed that, to an appreciable extent, it was possible to estimate the baking quality of flour by the ratio of the total nitrogen to the nitrogen soluble in water (1). They continued their study with different samples, considering the inverse ratio, which seemed preferable.

I. NORMAL FLOUR. — 1) *Flours of a bolting degree inferior to 70 %*. — The proportion of soluble nitrogen was about 17 % of the total nitrogen with a minimum of 16.1 % and a maximum of 19 %.

2) *Flours bolting over 70 %*. — The proportion of soluble nitrogen decreases as the bolting degree increases; proportions between 16.6 and 18.1 represent the best baking qualities.

3) *American flours*. — Many American flours very rich in gluten have a proportion of soluble nitrogen between 12.5 and 12.8 %. The addition of such flour improves native flours which "relâchent" (2), in which the ratio of soluble nitrogen to total nitrogen is very high; such addition lowers the ratio, making it almost normal.

II. ABNORMAL FLOUR (giving rise to difficulties in breadmaking). — The proportion of soluble nitrogen is above 20 %, more often about 22 %; it even rose to 62.5 % in a flour which had been stored a long time.

III. VARIOUS FLOURS. — The values found for the ratio soluble nitrogen: total nitrogen were: — maize, 18.1 and 18.5; rye, 22.7, 22.2 and 22.7; bean, 12.1; barley, about 12.1; rice, 4.27 and 4.20; one sample gave 2.5, another, although old, only 5.7.

The use of lime water in breadmaking (method of Messrs. LAPICQUE and LEGENDRE (3)) has a solvent action on the nitrogen and brings the proportion of soluble nitrogen of flours with a high bolting degree down to the normal.

The results may be summarised as follows: —

The presence of a certain percentage of soluble nitrogen in flour usually corresponds to a good absorption of water, and, consequently, to good kneading qualities of the dough, which is one of the most important qualities. The most advantageous proportion of soluble nitrogen to total nitrogen is about 16 to 17 %. If it rises or falls too much the flour will "relâche" and becomes of bad breadmaking quality. If the total nitrogen content is very high the flour is very hard to work.

The ratio of soluble nitrogen to total nitrogen, which is easily determined, can, therefore be of practical use in estimating the breadmaking qualities

(1) See B. May, 1913, No. 605. — (2) This term is applied to flour, usually made from badly harvested grain, which, after kneading, and when left for a time before being placed in baskets, gives out water which rises to the surface. The baker is obliged to add more flour and re-work the dough, thus obtaining less bread and a product of inferior quality. — (3) See R. Feb., 1918, No. 216. (Ed.).

of flour, not as an absolute criterion, but as a useful indication, especially when other analytical characters are lacking.

- 344 - **The Use of Chalk in Breadmaking.** — EFFTONT, JEAN, in the *Bulletin de la Société scientifique d'Hygiène alimentaire et d'alimentation rationnelle de l'homme*, Vol. V, No. 8, pp. 437-446. Paris, 1917.

In opposition to Messrs. LAPICQUE and LEGENDRE (1) who assert that the use of chalk inhibits the action of the soluble ferments contained in bran, which cause the acidification of bread, the author maintains that this acidity is not the result of enzyme action. The germinated grains may be treated with alkalis and acids in quantities 20 times higher than those at which enzymes in solution are destroyed without losing any of their active substances. Similarly, the soluble ferments of flour diluted in water\* can bear a temporary change in the reaction of the medium without any change occurring in the enzymes they contain. Sharps treated with chalk and then diluted in a mixture of flour and water keep all their active substances which, moreover, have no harmful effect on breadmaking.

The acidity of the flour, bad smell, bad keeping quality and the tendency of bread to go mouldy are not due to the enzymes of the bran, but to bacteria derived from insufficient cleaning of the grain and the presence of a large quantity of bran, the bacterial flora of which is richer than that of flour. The addition of 40 centigrams of chalk, as advocated in the new method, has no favourable action on the acidity, keeping qualities, or colour of the bread. In the presence of a fresh, strong yeast the amount of chalk advised has no action on the fermentation process. If the yeast is unsatisfactory, the introduction of chalk is certainly harmful.

Everything goes to prove that chalk bread is less easy to digest than ordinary bread, since the mono and tribasic phosphates, so favourable to salivary digestion, are replaced in the new bread by insoluble tribasic phosphates which have no influence on the very important first stage of digestion.

- 345 - **Tapioca Starch Made in Rhodesia.** — See No. 254 of this Review.

- 346 - **Copra Driers in Jamaica.** — WATES, L. A. in *The Journal of the Jamaica Agricultural Society*, Vol. XXI, No. 11, pp. 453-454. Kingston, Jamaica, November, 1917.

The increased production of copra in Jamaica has led to a large increase in the number of drying houses. During the last few years copra making has been carried out on a small scale on most estates, where, in nearly all the cases, it was dried on trays exposed to the sun. Today, practically every estate of any size has a drier. These driers are made on the model of that perfected by Mr. ED. ASHMAN at Boroughfield for drying cocoa. They consist of a practically air-tight wood or stone building, varying in size, containing a more or less large number of trays, heated by a furnace or stove, built in the wall, to which is attached a series of hot air pipes which

(1) See R. February, 1918, No. 216. (Ed.)

acts as a chimney or drought. A ventilator is let into the roof to regulate the heat.

Although all these driers are built more or less on the same lines, the details of their construction vary. Sometimes an ante-chamber, also practically air-tight, precedes the drying chamber. The trays are usually made of half-inch mesh wire on frames. The furnace of the best houses is so placed that the heating pipes start from about the level of the floor.

As a result of the different drying methods the quality of the copra produced also varies greatly, and often leaves much to be desired. The following technical points should be observed in drying the nuts and preparing the copra.

- 1) a white, pellucid copra, containing not more than 5 % moisture, should be aimed at ;
- 2) the split nuts should be exposed in the sun for half a day or so before use ;
- 3) the nuts should be kept in the drier at an initial temperature of from 160 to 170° F. for at least 12 hours ;
- 4) suitable ventilation for removing the moisture ;
- 5) final desiccation at 140° F.

A uniform distribution of the heat throughout the building, and constant and regular ventilation are essential to satisfactory drying. Since the hurricane of September, 1917, which blew down a large quantity of nuts, there has been great activity in making copra and further improvements are being made in the driers.

347 - **Wax from *Ceroxylon andicolum*.** — See No. 254 of this *Review*.

348 - **Note on the Fibre of *Wrightia annamensis*.** — CREVOST, C., in the *Bulletin économique de l'Indochine*, New Series, Year XX, pp. 48-491, figs. 2, plate 1. Hanoi-Haiphong, September-October, 1917.

*Wrightia annamensis* Eber. and Dub. (fam. Apocynaceae) occurs throughout Indochina; it is commonly called "Cay Long Muc" in Cochinchina, Annam and Tonkin, and "Chhœ u dâykhlâ" in Cambodia.

The author quotes the description by EBERHARD and DUBARD of this little tree whose wood resembles that of box. The fibres consist of hairs forming an umbrella round the seed. These hairs are lustrous, silky, wavy and slightly drooping; they are 3 or 4 cm. long, but there are much shorter hairs in the tuft; they taper slightly from the base towards the summit and have an average diameter of  $\frac{5}{100}$  to  $\frac{6}{100}$  mm. at the base, which is often reduced to  $\frac{1}{100}$  mm. at the summit. The wall is as much as 3 mm. thick, but it is usually 1.5 mm. They do not consist of pure cellulose, but of lignified cellulose.

Up to the present, all spinning tests have failed. The author boiled them in a lye to which soap was added (45 litres water, 230 gm. soap, 200 gm. Phenix lye). The product was turned slightly yellow by this bath, and unfortunately much of the natural lustre was lost. The mass of fibres thus treated and carded have the appearance of cottony down; the fibres



are tangled, waved, shrunk in places, and are suitable for spinning on the native wheel. The thread obtained from the spindle seems fairly well conditioned, but downy; spinning is rather delicate, and the thread is not so strong as cotton. Threads twisted together in 3, 4, or 5, gave strength like wool, and resemble soft wool to the touch. They easily dye with aniline colours. When knitted, a fabric is produced having a weight like that of wool, which it closely resembles. Weaving tests are to be undertaken.

The fibres of *Wrightia* might, on account of their cellulose, be used for making explosives.

The plant appears to occur over a large area in Indochina, and it seems to grow more quickly in southern than in northern regions.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

- 349 - **Parasitic Fungi Collected in the Government of Podolia, Russia** (1). — GARBOWSKI, L., in the *Bulletin trimestriel de la Société mycologique de France*,\* Vol. XXXIII, Pt. 3 and 4, pp. 73-91, figs. 1-4. Paris, 1918.

This is a list of 121 species of micromycetes living parasitically on cereals and other plants, both cultivated and wild, collected in 1915 in various districts of the government of Podolia. Four species are mentioned as being new to science, amongst them *Fusariella Populi*, found on leaves of *Populus tremula*, and *Macrosporium somniiferi*, on living leaves of *Papaver somniferum*.

- 350 - **Fungi of Southern China** (2). — YATES HARRY S., in *The Philippine Journal of Science* Section C, Botany, Vol. XII, No. 5, pp. 313-316. Manila, September, 1917.

This paper contains a list of fungi collected by Mr. E. D. MERRILL in Kwantung Province, in October and November, 1916. It includes: —

- 1) *Parodiella perisporioides* (B. and C.) Speng., on leaves of *Desmodium triflorum*, Canton (Honam Island);
- 2) *Trabutia chinense* n. sp., on leaves of *Ficus* sp., Loh Fau Mountain (Lofaushan);
- 3) *Phyllachora Coicis* P. Henn., on leaves of *Coix Lacryma-Jobi*, Canton;
- 4) *Phyll. Cynodontis* (Sacc.) Niessl., on leaves of *Cynodon Dactylon*, Canton;
- 5) *Phyll. orbicula* Rehm, on leaves of *Bambusa Blumeana*, Canton;
- 6) *Puccinia Cynodontis* Desm., on leaves of *Cynodon Dactylon*, Canton;
- 7) *Pucc. heterospora* B. and C., on leaves of *Prunus Persica*, Canton;
- 8) *Uredo cantonensis* n. sp., on leaves of *Melothria indica*, Canton;
- 9) *U. philippinensis* Syd., on leaves of *Cyperus* sp., Canton;
- 10) *Uromyces linearis* B. and Br., on leaves of *Panicum repens*, Canton;
- 11) *Ustilago Cynodontis* P. Henn., on inflorescences of *Cynodon Dactylon* Canton;

(1) See also R. Sept., 1917, No. 872. (Ed.)

(2) See also B. July, 1912, No. 1099; B. June, 1913, No. 754; B. June, 1914, No. 578. (Ed.)

12) *U. Koordersiana* Bref., on inflorescences of *Polygonum* sp. Canton ;

13) *Cercospora personata* (B. and C.) Ellis, on leaves of *Arachis hypogaea*, Canton ; this fungus is the cause of a serious disease of the peanut in the West Indies ; it has also been reported from the United States (1) and India, and is abundant on the leaves of Leguminosae in the Philippines ; it is very similar to, and may be identical with *Septogloeum Arachidis* Rac., which causes a serious disease of peanuts in Java and has also been reported from Ceylon ;

14) *Helminthosporium Ravenelii* Curt., on inflorescences of *Sporobolus elongatus*, Canton.

*Pseudomonas Citri* Hasse is also mentioned as living on leaves of *Citrus* sp. at Canton ; this bacterium, the cause of Citrus canker (2) was not found in the material examined, but the general appearance of the infected areas was that caused by this well-known microorganism.

351 - Varieties of Swede Resistant to "Finger and Toe" (*Plasmidiophora Brassicae*), in Denmark. — See No. 282 of this Review.

RESISTANT  
PLANTS

352 - Varieties of Flax Resistant to *Fusarium lini*, in the United States. — See No. 283 of this Review.

353 - Asparagus Resistant to Rust (*Puccinia Asparagi*), in Massachusetts, U. S. A. — See No. 285 of this Review.

354 - "Minnesota No. 1107" a Variety of Strawberry Little Resistant to Fungous Diseases, in the United States. — See No. 298 of this Review.

355 - Disease Resistant Direct Bearers ; Observations in France in 1917. — See No. 303 of this Review.

356 - Chestnut Hybrids Resistant to Canker (*Endothia parasitica*) in the United States. — See No. 286 of this Review.

357 - Patents for the Control of Diseases and Pests of Plants. — See No. 337 of this Review.

MEANS  
OF PREVENTION  
AND CONTROL

358 - *Bacillus atrosepticus*, a Cause of "Blackleg" in Potato in Lancashire, England (3). — PAINE, SYDNEY, G. in *The Journal of Agricultural Science*, Vol. VIII, Pt. 4, pp. 480-494. Cambridge, 1917.

The damage done in Great Britain by potato bacteria is not so extensive as that done in other countries of Europe, the United States, and Canada. The loss caused probably does not exceed 5 % of the whole crop of Great

(1) See also R. May, 1916, No. 581, and R. May, 1917, No. 492. (Ed.) — (2) See also B. July, 1915, No. 763 and R. December, 1916, No. 1337. (Ed.) — (3) See B. Nov., 1910, p. 157. (Ed.)

DISEASES  
OF VARIOUS  
CROPS

Britain, but it may become more serious at any moment, as certain indications show.

Four or five different bacteria have been described in other countries as causing the disease of potatoes known as "Blackleg", but the cause in England has not yet been identified. The author undertook to determine which of the various microorganisms mentioned actually exist in Great Britain. For his research he used material collected in August, 1916 in the neighbourhood of Ormskirk (Lancashire).

The experiments lead to the conclusion that the bacterium causing Blackleg in Lancashire is *Bacillus atrosepcticus* (van Hall), which the author succeeded in isolating with great difficulty, and the morphological, cultural and physiological characters of which he describes in detail. Infection experiments gave positive results. This bacterium is in every way identical with that considered to cause the same disease in Ireland and described by PETHYBRIDGE and MURPHY under the name of *B. melanogenes*.

359 - Notes on Downy Mildew of the Vine in Australia. — CASTELLA, F. DE and BRITTLEBANK, C. C., in *The Journal of the Department of Agriculture of Victoria, Australia*, Vol. XV, Pt. II, pp. 685-700, figs. 1-2. Melbourne, November, 1917.

Till the summer of 1916-1917 Australian vineyards had not been attacked by downy mildew (*Plasmopara viticola*). The fungus had been reported, it is true, but only in an isolated case, on a private vineyard at South Yarra. The plant was uprooted and burnt and the disease was not again observed in Australia till January 31, 1917. Since then the fungus has appeared suddenly over wide areas of the north-east of Victoria.

As a rule the outbreak was slight. No damage was done and the fungus was not sufficiently in evidence, at least in any of the vineyards affected, to cause apprehension or to make spraying advisable. The origin of the 1917 outbreak is obscure, but there is no doubt that the excessive wetness of the summer was responsible for its development and spreading over so large an area.

It has been suggested, perhaps rightly so, that the grafted resistant rootlings imported from France during the last 10 years have acted as carriers. It is also possible that the fungus was introduced with dried grapes from Spain, Greece and Turkey. It is equally probable that the fungus existed in Victoria for a long time, but that, owing to climatic conditions, the white, downy efflorescence by which it is identified, was unable to manifest itself till the very wet summer of 1916-1917.

A description is given of the outward appearance of the disease, the damage it causes, the life history of the parasite and the methods of control used in Europe.

In normal summers Australian vine-growers, as those of California and the Cape, probably have little to fear from mildew, but the summer of 1917-1918 threatens to be even wetter than the preceding one. Spraying, when necessary, should prove much more efficacious in Australia than in France.

360 - Citrus Diseases in Surinam. — See No. 300 of this Review.

- 361 - *Blepharospora cambivora* n. gen. and n. sp., a Cause of "Ink Disease" in Chestnut Trees. — PETRI, L., in *Rendiconti delle sedute della R. Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Ser. 5, Vol. XXVI, Pt. 2. pp. 297-299. Rome, 1917.

In his last report on his investigations into "ink disease" of chestnut trees the author concluded that the causal parasite was a multicellular mycelium of intercellular and intracellular reproduction which remained unicellular for a more or less prolonged period, and formed in the cambium globular and threadlike haustoria. The mycelium, although grown on the most varied media, had always remained sterile (1).

Later investigations enabled the author to cause the formation of spores the characters of which place the parasite among the Saprolegniineae (Schröter) while bringing it near to the *Pythiaceae* and the *Peronosporaceae*. While waiting to give a fuller description later, the author calls this member of a new genus and a new species *Blepharospora cambivora*.

To produce the disease artificially the mycelium was inoculated into healthy chestnut trees at the "R. Istituto superiore forestale nazionale" at Florence. Isolated trees and those in plantations near infected centres in the province of Cuneo (Mondovì) were used. Of 13 chestnut trees from 5 to 6 years old, planted and inoculated on May 26, 1916, 9 were dead or dying about two months later. The characteristic brown spots of the collar rose towards the epigeal base of the stem and descended towards the most superficial roots. In trees about 60 years old the infection spread in six months from the cambium over about  $\frac{1}{8}$  of the whole circumference of the trunk.

In experiments carried out in Piedmont inoculations were made in August 1917, at the base of stems of young, strong shoots of chestnut trees of 10 to 15 years old in the Alma district of Frabosa Sottana (Mondovì). This district had not been attacked, but was next to a centre of infection. On October 2 some of the plants were examined and the infection was seen to have spread over almost half of the circumference of the stem, descending towards the collar. In some cases necrosis of the tissues was shown by a depression and brown coloration of the bark. The characters of the cambium and cortical tissues were identical with those of chestnut trees attacked by "ink disease".

- 362 - *Diaporthe taleola*, an Ascomycete Injurious to Oaks, in Switzerland. — MORELON, M., in the *Journal forestier suisse*, Year LXIX, No. 1, pp. 1-3, 1 plate. Berne, January, 1918.

During the second fortnight of September, under a slight wind, oaks (*Quercus pedunculata*, *Q. sessiliflora* and *Q. pubescens*) of 50 to 150 years old, isolated in coppices, on dry, calcareous soil, not very deep-rooted, to the south-west of the Vaudois Jura (Montcherand, at an altitude of about 1850 feet) lost several of their twigs. In some cases were counted ten branches per square yard, measuring as much as  $\frac{1}{2}$  inch in diameter and nearly 20 inches in length representing a premature loss of a maximum of 1% of the twigs of the tree.

(1) See R. Oct., 1917, No. 973, (Ed.)

An examination of these twigs showed their loss to be caused by *Diaporthe taleola* Fries. Similar damage was observed by the author in the copses of Corcelles-sur-Chavornay (1 900 feet), on clay, and at Sauvabelin, near Lausanne (2 030 feet), on molasse. Isolated oaks on the Zürichberg, above the town of Zurich, were also recently found to be attacked by the same fungus. This fungus had already been reported by Dr. VON TAVEL in 1903 on the Käferberg, near Zurich, and yet earlier (1893) R. HARTIG had drawn attention to the damage done by the ascomycete to oaks of about 35 years old in Germany and in Austria.

363 - *Chrysomyxa Abietis* in England and Scotland. — HILEY, W. E., in the *Quarterly Journal of Forestry*, Vol. XI, No. 3, pp. 191-192. London, July, 1917.

On May 15, 1917 in a small wood of mixed trees, south of Ridsdale, Northumberland, were found two spruces badly attacked by *Chrysomyxa Abietis* (Wallr.) Ung. The two trees were growing together and were badly stunted, but this could not be attributed to the fungus as only the leaves of the preceding year were attacked. One tree of normal size also had yellow patches caused by the fungus on some of its lower branches.

The presence of this fungus had not hitherto been reported in England; it was probably introduced from Scotland, where it has been frequently observed of recent years. The first report of the appearance of the parasite came from Aberdeenshire in 1911, where it was found on the estate of Durris, in the Dee valley. Later it was again observed in the same district, and, in 1916, was recorded from Perthshire.

Infection in England probably occurred in 1916, for, though the author could find no trace of the parasite on the 1915 shoots, the two above-mentioned trees were attacked on all the 1916 twigs except those at the top.

## WEEDS AND PARASITIC FLOWERING PLANTS

364 - Devil's Fig (*Solanum largiflorum*), a New Weed in Queensland. — WHITE, C. T. in the *Queensland Agricultural Journal*, Vol. VIII, Pt. 3, pp. 170-172. Brisbane, September, 1917.

This paper gives a botanical description of a new *Solanum* found up to the present in the Kin Kin district, Bundaberg and Childers, but doubtless growing in other districts as well. It has recently been reported as a great pest in the first of the three above-mentioned districts.

The plant was first considered to be a southern form of *S. Dallachii*, from which it differs in some respects. It does not seem to agree with any of the extra-Australian species. It is commonly called "Devil's Fig", but is also known as "Chinese Fig." This latter name is undesirable as the plant is native. The aboriginal name "Koori" of the old Bundaberg natives given under *Solanum Dallachii* by F. M. BAILEY (*Queensland Flora*, p. 1087) belongs to this new species.

If the weeds are few they may be grubbed out; repeated cutting off close to the ground exhausts the vitality of the plant, but this treatment

must be persistent to succeed; a little brine or caustic soda and arsenic about the cut surface is useful. Spraying with arsenical solutions does not seem of much value and is out of the question where cattle graze, but the injection of an arsenical solution into the main root or branch should prove successful.

365 - A Machine for Destroying Weeds. — See N.o 334 of this *Review*.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

366 - Biological Observations on Some Insects in the Department of Hérault France. — PICARD, F., in the *Bulletin de la Société entomologique de France*, No. 19, pp. 355-357. Paris, 1917.

GENERAL

Special mention should be made of :

*Lixus iridis* Ol. — This curculionid, common on aquatic umbelliferae (*Helosciadium* = *Apium*, etc.), is sometimes injurious to celery near Montpellier.

*Pieris brassicae* L. — Among the parasites of the large white cabbage moth should be included the ichneumon *Pimpla alternans* Grav., which undergoes metamorphosis in the larvae of the macrolepidopteron. Three specimens reared by the author emerged November 30, 1917. It should be noted that this *Pimpla* does not develop in the larva but in the winter chrysalis of *Clysia ambiguella*.

*Pyrameis cardui* L. — The larva of this macrolepidopteron was reared on *Parietaria officinalis*.

*Charaxes jasius* L. — CH. OBERTHÜR doubts the presence of this lepidopteron in Languedoc. It is sometimes, though rarely, found in Hérault wherever the strawberry tree (*Arbustus Unedo*) grows. The author found larvae of the insect on specimens of Ericaceae at the School of Agriculture of Montpellier, and has been assured by all the lepidopteron collectors he has consulted that the adult insect has been taken in the gardens of the town and in several other localities.

*Carpocapsa pomonella* L. — This tortrix (apple pyralis) lives at Montpellier on the fruit of *Diospyros Kaki*, *D. Lotus* and other plants of the same genus. It did great damage to the crop in 1912 and 1913, a year in which the first generation of the microlepidopteron destroyed almost all the fruit.

*Agromyza abiens* Zett. — This dipteron was reported by P. MARCHAL as damaging artichokes near Perpignan. The author found it at Montpellier in the same plant under the same conditions. The larvae burrow in the leaves, along the veins, longitudinal galleries with very characteristic quadrangular expansions. There are many generations and damage is done in all seasons. The larvae were particularly numerous during the winter of 1913-1914; the exceptional cold of January, 1914, killed the greater part of them. Since then, the species, although it has not disappeared entirely, has become practically harmless.

*Scleroderma domesticum* Latr. — In the Montpellier Botanical Gardens

this proctotrupid hymenopteron is parasitic on the coleopteron *Phlaeosinus thuyae*, and the adult insect hibernates under the bark of cypress in galleries hollowed by the scolytid.

*Myrmecophila acervorum* Panz. — This myrmecophilous orthopteron is fairly common in the Department of Hérault. A long list of formicidae (genera *Camponotus*, *Formica*, *Lasius*, *Myrmica*, *Tetramorium*, *Solenopsis*) on which it may live has already been given. To the author's knowledge the gryllid has not yet been reported on members of the *Cremastogaster* genus. It is under bark, especially that of *Pinus halepensis*, in which is *Crem. scutellaris*, that this species of *Myrmecophila* is almost exclusively found, at least in Hérault. It is rarer under flat stones, where the author has found it with another formicid, *Pheidole pallidula*.

367 - Life History of *Macrosiphum illinoisensis*, the Grapevine Aphis. — BAKER, A. C., in the *Journal of Agricultural Research*, Vol. XI, No. 3, pp. 83-89, plates 8-9. Washington, October 15, 1917.

A short note on the alternation in food plants by this species was published in 1915 by BAKER and TURNER (1). The aphid was first described by SHIMER in 1866 under the name of *Aphis illinoisensis*. Later, in 1879, THOMAS described it as *Siphonophora viticola*, and it was always mentioned under the name of *viticola* Thos., until DAVIS, when listing the aphids of Illinois in 1910, drew attention to SHIMER's description and gave *viticola* Thos. as a synonym of *illinoisensis* Shimer.

The species is very abundant on wild grapes (*Vitis* spp.) in the more southern parts of the United States and often damages the cultivated varieties. Specimens of it have been collected in the District of Columbia, Georgia, Indiana, Maryland, Missouri, Mississippi, North Carolina, New Jersey, New York, Oklahoma, Pennsylvania, Texas and Virginia. An aphid which might belong to the same species was found on the vine at Campinas, Brazil, in September, 1898.

As there is no complete study in scientific literature of the different forms of the aphid the author considered it wise, in view of the economic importance of the insect, to record briefly the results of some of the most recent studies on it and to give a full description of the life history of the species.

368 - *Lepidium apetalum*, the Secondary Host of *Myzus cerasi* in Ontario, Canada. — ROSS, W. A. *The Canadian Entomologist*, Vol. XLIX, No. 12, p. 434. London, December, 1917.

Among entomologists there is a difference of opinion as to whether *Myzus cerasi* Fabr. (cherry aphid) is migratory. CROSBY considers the question undecided. SANDERSON and O'KANE state that, so far as is known, the aphid has only one food plant. GILLETTE states definitely that *M. cerasi* cannot change hosts. On the other hand, QUAINANCE and BAKER claim that the species is migratory.

(1) See B. Sept., 1915, No. 990. (Ed.)



The author's observations lead him to conclude that this aphid is partially monophagus and partially migratory. Apterous forms live throughout the season on the primary host — cherry — and alatae, born in summer, migrate and form colonies on a secondary host. In Ontario, according to the author's observations, the favourite secondary host is *Lepidium apetalum* (wild peppergrass). He collected several *M. cerasi* from this weed and succeeded repeatedly in transferring it from the cherry to peppergrass. There is no doubt that other crucifers serve as summer hosts. In insectary experiments the author successfully established colonies of *M. cerasi* on *Capsella Bursa-pastoris*, *Brassica arvensis* and *Erysimum cheiranthoides*, but the results have not yet been verified in the field.

- 369 — Sweet Sorghum Varieties Resistant to the Corn Earworm, in the United States.  
— See No. 279 of this Review.

RESISTANT  
PLANTS

- 370 — *Perezia mesnili* n. sp., a Protozoan Parasite of the Larvae of the Large White Cabbage Moth (*Pieris brassicae*), in France. — PAILLOT, A., in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXI, No. 2, pp. 66-68, 1 fig. Paris, 1918.

MEANS  
OF PREVENTION  
AND CONTROL

The paper describes a new microsporidium found in the larvae of *Pieris brassicae* collected in the Sathonay-Rillieux, Lyons, district. It attacks exclusively the Malpighian tubes and the silk glands of a fairly small percentage of the larvae of the macrolepidopteron. The author places this protozoan temporarily in the genus *Perezia*, but under the name of *P. mesnili* n. sp.

- 371 — *Hyperecteina polyphylla* n. sp., a Dipterous Parasite of the Injurious Coleopteron *Polyphylla fullo* in Russia. — VILLENEUVE, J., in *Bulletin de la Société entomologique de France*, No. 17, pp. 306-309. Paris, 1917.

Mr. Z. GOLOVIANKO, of Borispol (Russia) published at Kiev, in 1916, a study, printed in Russian and illustrated with many figures, on the development of two flies, one of which, in the larval stage, is saprophagous on a dead lamellicorn beetle, *Polyphylla fullo*; the other, parasitic on the same coleopteron, lays its eggs on the stomach of the living animal.

The author, taking as basis material sent to him by Mr. GOLOVIANKO, has ascertained the saprophagous dipterous, represented by two females, to belong to the genus *Sarcophaga*; this cannot be positively stated as there were no males.

The parasitic dipterous is an undescribed species which also exists in France; it belongs to the genus *Hyperecteina* and is closely allied to *H. metopina* Schiner, for which it has been mistaken. The author describes the insect under the name of *H. polyphyllae* n. sp. He possesses a male of this new species taken at Cape Breton (Landes) by Mr. J. DE GAULLE and has examined the two females sent by Mr. GOLOVIANKO.

- 372 — *Cosmopteryx phaeogastra* n. sp. and *C. bambusae* n. sp., Microlepidoptera attacking Beans and Bamboo respectively, in India. — MEYTRICK, E., in *The Entomologist's Monthly Magazine*, Vol. LIII (3rd. Ser., Vol. III), No. 642 (No. 35) pp. 257-258. London, November, 1917.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

This paper gives a morphological description of: —

1) *Cosmopteryx phaeogastra* n. sp., from larvae mining blotches in leaves of beans, at Pusa,

2) *C. Bambusae* n. sp., from larvae mining blotches in the leaves of bamboo, at Pusa.

373 - **Citrus Pests in Surinam.** — See No. 300 of this Review.

374 - ***Rhynchites baccus*, a Coleopteron Injurious to Apples, Apricots and Plums, in Sicily.** — DE STEFANI, T., in *Nuovi Annali di Agricoltura Siciliana*, Year VI, Ser. 6, Pt. 4, pp. 178-191. Palermo, 1917.

Repeated observations made by the author during a number of years shows that very serious damage is caused in the orchards of the mountains of Renda, in the Monreale district (province of Palermo), by the curculionid *Rhynchites bacchus*, and, to a much lesser degree by other insects of the same genus, such as *Rhynch. giganteus*, *Rhynch. auratus* and *Rhynch. ruber* (1).

*Rhynch. bacchus* attacks apricots and plums but especially apples. During many years the harvest was completely lost, and the author observed that the whole crop of apples and plums may be destroyed in about a week.

On apples and apricots the insect lays many eggs, but, according to the author's observations, only one on plums. Having laid its egg on the plum, the insect cuts the peduncle in about the middle, thus causing the fruit which is to feed the larva to fall to the ground. In apples and apricots, however, it either cuts the peduncle partly or not at all, so that the fruit dries up on the tree, falling only during wind or the autumn rains. Damp causes the fruit to soften and decompose, enabling the larvae within to enter the soil and complete their metamorphosis there.

All the insects do not lay eggs in good time. They do not, however, die during winter, but hide in a sheltered spot where they await spring, and the attack the fruit as soon as it has set. The author has found specimens of *Rhynch. bacchus* in November, December and January.

From many dried-up apples containing larvae of this coleopteron picked from trees by the author, emerged in September two parasitic hymenoptera, *Eupelmus degeeri* and a member of the genus *Syntomaspis*, which may form a new species. The former was present more frequently than the latter, but always in limited numbers, which leads the author to believe that these natural enemies are not really of importance.

The best methods of control are to collect the fallen fruit, each day at the same time in all infested orchards, and to pick that which is attacked but is still on the tree. The larvae in this fruit should then be killed. As a means of obtaining the desired result without total loss of the product, the author advises that the infested fruit be boiled and then given as food to pigs.

(1) See B. Aug. 1912, No. 1240; B. July, 1914, No. 693. (Ed.)

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

375 - **Agriculture in Crete.** — FRANCHET, L., in the *Revue Scientifique*, Year LVI, No. 3, pp. 75-81. Paris, February 2-9, 1918.

Crete is essentially an agricultural country, but cultivation there is still in a primitive state.

VINE GROWING. — Vine-growing, though remarkable in Crete, is much inferior to what it ought to be. The quality of the produce is entirely due to the exceptional climatic conditions and in no wise to the work of the growers. There are many varieties of grapes but the principal and only really appreciated ones are:—

*Black grapes*: — Cotzifalei, Mendillarei; Liatico.

*White grapes*: — Rasaccia, Croutakta, Sultanine.

The wine is of medium quality only, owing to inadequate methods of preparation, for it could be excellent. The best red wine is made from the Cotzifalei grapes. Wine made with Mendillarei grapes is less alcoholic than the former, whereas that made with Liatico grapes is more alcoholic; it is also less dark than that made with other red varieties.

Of the white grapes, Rasaccia is chiefly used as a dessert grape, and Croutakta for wine-making.

The Cretan wines would be excellent dessert wines, of the Marsala type. The production of wine is estimated at 2 970 000 imperial gallons; it could easily be increased tenfold. Certain wines have, on an average, 14 to 16°, but some occasionally are as high as 17°, and even 19°, according to the year.

Crete exports raisins, but in small quantities only. For this purpose the Croutakta variety is chiefly used, and prepared as follows: — the grapes are steeped for some hours in a solution of carbonate of soda, then left to

dry. They are generally sold only loose, the peduncle having been detached by the worker (women usually do this work) with her teeth. This method was the only one in use in Crete and Asia Minor till about 1910, but nowadays the peduncle is usually removed by machine. These raisins are exported and used in pastry-making, especially in Germany and Austria. The yellowish Sultanine variety, also known as "Corinthian", is also harvested. The peduncle is removed by machine and the raisins exported to Germany, Austria and Egypt.

The wine, residue and dried grapes are treated locally for the manufacture of alcohol, which is used in the country, the surplus being exported to the East. The annual production is from 352 000 to 396 000 gallons. The reddish alcohols, obtained by simple distillation, differ greatly in degrees, varying from 30 to 90°. The standard of the cognacs is from 38 to 45°.

Experiments on the manufacture of alcohol with locust-beans have not given satisfactory results.

**CEREALS.** — The cultivation of cereals is practically non-existent. The few natives and Turks who cultivate fields grow wheat and barley for their own use. The methods have remained unchanged for about 4 000 years. When the rich Messara plain is cultivated by modern methods it will yield sufficient wheat to supply the whole island with flour. At the present day about 12 000 metric tons of flour of different qualities are imported from Italy, Rumania and Bulgaria.

**OLIVE TREES.** — Olive trees, which grow with great ease in Crete, might prove one of the principal crops; in spite of the neglected condition of the trees they give an abundant yield. King George I made an attempt to improve the cultivation of olives by bringing specialists over from Italy to teach peasants the art of pruning. Unfortunately this experiment did not continue, and owners of olive orchards not only continue to neglect their tree, to the great detriment of the yield and quality of the fruit, but also to cut them for use as firewood, without considering the wealth they are gradually destroying.

The olives of Crete are of three qualities: — the psiloolies, small olives yielding a good oil, the chondroelies, large olives giving a less appreciated oil, and the tsounates, medium olives very rich in oil, but of which, unfortunately, there are only a few in the island. The harvest is from October to November.

When ripe the olives are not picked or knocked down with a pole, but left till they drop. Often they are not collected from the ground till partly rotten. The oil is extracted by crushing, but there are three factories which extract oil from the cake by the carbon bisulphide method. The yield is very variable, varying from 5 to 15 %.

The residue from the bisulphide treatment is thrown away, though, since it still contains 71 % of organic matter, it could be used as a fertiliser. A very small quantity of the olive oil is used for soap-making. The annual yield is about 5 500 000 lbs., only  $\frac{1}{7}$  of the yield about forty years

ago. This industry, in which primitive methods are still used, could develop largely if modern methods and material were employed.

**CITRONS.** — The citron, grown in the positions best exposed to the sun and sheltered from the north wind, yields abundantly. The fruit is gathered in August and December, and exported chiefly to the United States, England and Germany. Unfortunately the trees are subject to many diseases which do great damage, especially when the wood splits and the sap flows.

The fruit is not exported fresh, as it would not stand so long a journey, but is put in brine. It is cut into two or three, placed in barrels, and left to soak in sea-water with a large quantity of salt. It is left thus for several weeks, then taken out and sorted into two or three qualities. The pieces are then put back into the barrels, and well pressed. When the bottom of the barrel has been fixed, a hole is made in it and a new, very strong brine introduced. The barrel is then hermetically closed and is ready for export.

**TOBACCO.** — The climate, as well as the soil of Crete, are very favourable to tobacco growing. It was started seriously in 1899, and in 1901 the yield had risen from 33 000 lb. to 275 000 lb. When, however, the Greek Government took over the monopoly of tobacco, the native crop was completely ruined, and today only very medium tobacco imported from Greece or Turkey is used in the island.

The native tobacco itself is not good, but this is due solely to the method of preparing it; if well cultivated and well prepared, Cretan tobacco could rank with that of the best quality.

**VARIOUS FRUITS.** — Crete produces lemons, tangerines which are much appreciated, cherries, and apricots; the Japanese medlar does particularly well there. When the soil is treated by modern methods fruit production may become of considerable importance.

**STOCK BREEDING.** — Properly speaking stock breeding does not exist in Crete, and the flocks of sheep or goats belong to peasants who keep them for their own consumption, selling only the surplus. The rare oxen or cows are kept only as draught animals, for the Cretans do not like cows' milk and hardly drink goat's or sheep's milk. The little milk drunk in the towns is almost exclusively imported concentrated milk.

Goat and sheep's milk are used in the manufacture of inferior quality cheese, which turns rancid rapidly. The Cretans however, excel in the making of "yoghurt", curdled sheep's milk, a large quantity of which is consumed locally, and is also exported to Turkey and the coast of Asia Minor; Cretan yoghurt is famous in the East. Butter is not made, food being prepared with oil.

Cattle breeding could be successfully attempted, especially in the eastern part of the island, and should give very good results. If goats and sheep were bred rationally they might prove a source of great profit and permit the utilisation of the uncultivated mountainous parts of the island.

376 - **Agriculture and Forestry in Cyprus.** — MIDDLETON J. P., in *The Quarterly Review*, No. 451, pp. 401-423. London, 1917.

**AGRICULTURE.** — The cultivation of cereals on primitive lines is essentially the principal industry of the island; most of the land is held by the peasants as proprietors, but in some places the métayer system prevails. There are about 1 100 000 acres of cultivated land, and it is estimated that some 325 000 acres are still susceptible of cultivation.

A Department of Agriculture, staffed by a Director and other Assistants, including a veterinary surgeon, is endeavouring with some success to induce the farmers to adopt the use of manures and improved implements and systems. An experimental farm, started in 1903, was in 1907 converted into a stock and horse-breeding establishment, by means of which the general standard of stock and the native ponies have been much improved. The Government has also started ostrich breeding, an experiment so far not attended with quite the success anticipated. Cattle, horses, sheep, pigs and poultry, however, show, by their improvement in character and value, the wisdom of the Government efforts.

The cultivation of the vine, which extends over a large area, produces red and white wines of various types, forming one of the main staples of Cyprus trade. The application of sulphur to the vines has been made compulsory, and the extension of vine disease has thus been greatly lessened. The manufacture of wine is still generally primitive, but an English company, established for some twenty years, buys up the peasants' grapes and makes wine of a better character. Excellent brandy is also manufactured at Limassol. The value of wine exported in 1879 was £31 600; in 1880 it reached £46 000, rose to £53 685 in 1911, but fell again to £43 060 in 1913. These figures do not show any great increase in the output of wine, but there seems to have been a considerable extension in the production of raisins in later years, for whereas, in 1911 the value of raisins exported amounted to £29 636, it increased in 1913 to £39 002. This seems to show that it pays better to transform the splendid black grape of Cyprus into dried fruit than to manufacture wine.

Irrigation, as a Government undertaking has not apparently been attended with the success expected, partly owing to the thrifty habits of the peasants who wait for rain until the last moment; and partly owing to the evaporation consequent on summer storage. It appears that only some 600 acres of summer crop in the shape of cotton are grown. The peasants have their own rough methods of irrigation. There is no doubt that irrigation works wonders on the arid surface of the soil and amply repays its cost. Convinced of this the Government formed its first reservoir at Synkrasi; and others have since been completed. But the system of storage irrigation does not seem to commend itself to the villagers; and reclaimed lands attached to the reservoirs are but slowly taken up. In one of the reservoirs also the water has proved brackish and unsuitable for watering crops. The State only takes a "small fraction of the total increased production", while a considerable outlay is involved in paying compensation for land; the prospect of financial success is therefore uncertain at present.

Cyprus has suffered from the plague of locusts from time immemorial; and remedies for it engaged the attention of the English Government soon after the occupation. Each year the "screen and pit" method suggested by M. MATTER has been applied; and by means of this plan and by purchase of the eggs and the insects themselves at the suitable seasons the scourge was practically eradicated, but at a considerable expenditure, which was met by a Locust Tax. The surplus funds arising from this tax, which was in existence for some years, have afforded a convenient reservoir for unexpected emergencies. In later years, on a recrudescence of the plague, treatment by means of noxious chemicals has been tried, but met with objection from the peasants. A compromise has been effected under which this treatment is only applied to places where there is no risk to the animals of the villagers, while the old system of purchasing eggs and insects in their immature stage is resorted to elsewhere.

FORESTRY. — In ancient days Cyprus was no doubt rich in timber, and its mountain districts were clothed with trees varying with the altitude. In 1878, when Cyprus passed under British control, the condition of the so-called forests was deplorable, and it was clear that strong steps, aided by scientific knowledge and a Government Department, must at once be taken to remedy and stop the cause of destruction. An Ordinance was passed in 1879 for the delimitation and preservation of the forests; and successive Forest Officers sought to remedy some of the abuses by prosecution in the Courts, while the forest areas were gradually delimited and settled. They now extend to some 700 square miles.

The trees consist principally of the Aleppo pine, but, at an elevation of 4000 ft. and over, of *Pinus Laricio*. Large tracts are also covered with *Quercus alnifolia*, which is much in demand for making native ploughs and carts, while *Arbutus* flourishes in many places on the slopes of the hills and is used in the manufacture of rough furniture.

With very small sums voted annually to the Department, protection was the only course open to those in charge; and no progress in artificial reafforestation was made till many years after the occupation. Since 1907 special tree-planting has made considerable progress, some 300 miles of fire-paths have been made, and goats will gradually be excluded altogether by means of legislation passed in 1913 on the principle of local option for each village. The police protection has on the whole always been good, and there is no doubt that the forests of Cyprus are now in a fair way to recovery, and are likely to become an added source of beauty and prosperity to the island. It may be interesting to note in this connection that the rainfall appears of late years to have increased.

377 — A Biological Analysis of Pellagra-producing Diets. II. The Minimum Requirements of the Two Unidentified Dietary Factors for Maintenance as Contrasted with Growth (1). — McCOLLUM, E. V. and SIMMONS, N., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 2, pp. 181-194 + 6 diagrams. Baltimore, Nov., 1917.

The authors draw attention to the fact that the previous experiments carried out at the Laboratory of Agricultural Chemistry of the University

RURAL  
HYGIENE

(1) For a review of the first part of this study see R. Jan., 1918, No. 2. (Ed.)

of Wisconsin, Madison, proved that of the four "deficiency diseases" — beri-beri or polyneuritis, scurvy, rickets and pellagra — caused, according to FUNK, by the absence of vitamins, only beri-beri can be called a "deficiency disease", in the sense the term is used by FUNK (*i. e.* caused especially by the deficiency of the water-soluble B), the other three being due to unsatisfactory relationships between the well recognised constituents of the normal diet. To polyneuritis must now be added another "deficiency disease", xerophthalmia, described in Japan by M. MORI (*Jahrbuch für Kinderheilkunde*, Vol. LIX, p. 175, 1904), in Denmark by G. E. BLOCH (*Ugeskrift for Læger*, Vol. LXXXIX, p. 349, 1917), and in Germany by A. CZERNY and A. KELLER (*Des Kindes*, Leipzig, 1906, Pt. 2, p. 67). This disease appears in children fed on a diet too rich in cereals and too poor in fats, and is manifest by emaciation accompanied by xerosis of the conjunctiva and keratomalacia, often ending in blindness. Experiments at the University of Wisconsin have shown that a diet deficient in the fat-soluble A causes, in animals, emaciation, oedema of the eyes, blindness and death. The animals may be cured, even when dying, by administering fats rich in the fat-soluble A (1), xerophthalmia being attributed to a lack of this factor in the composition of the diet.

The aim of the experiments described in this paper was to ascertain the quantity of each of the two unidentified dietary factors, A and B, necessary to the maintenance and growth of young rats. Wheat germ was chosen as source of the water-soluble B, and butter fat as that of the fat-soluble A. The diet was known to suffice for normal growth and prolonged maintenance of health when an adequate supply of both of the unidentified essentials was furnished. The diet consisted of: — casein 18.0, dextrin 76.3, salt mixture 3.7, agar-agar 2.0 %. It was fed: — *a*) with an abundance of fat-soluble A (as butter fat); *b*) with an abundance of water-soluble B (in wheat germ); *c*) with varying amounts, always below the optimum requirements, of both wheat germ and butter fat as sources of these two factors.

The results of the different experiments gave the following answers to the various questions raised: —

1) Assuming each of the food products, butter fat and wheat germ, to be of constant quality, what is the lowest intake of each which can supply enough of the A and B respectively just to prevent loss of weight? — The results show that a low plane of intake causes loss of vitality. When the minimum amount necessary to prevent loss of weight is approached, the life of the animal is endangered if the diet is persisted in.

2) When both essentials A and B are supplied in amounts just above the maintenance requirements will growth be proportional to these amounts,

(1) The fat-soluble A is found in fats of animal origin, such as the fats of butter and egg, and the fats extracted from internal organs (kidney, liver, etc.); it is abundant in leaves and in very few seeds (flax and millet); it is very scarce in animal body fats and absent in vegetable oils and fats. (*Journal of Biological Chemistry*, 1913, Vol. XV, p. 167; Vol. XVI, p. 423; *American Journal of Physiology*, Vol. XLI, p. 361, 1916 (*Author*).



or is a certain excess of each over this minimum necessary before growth in the young can take place? — The results show that, within certain limits, growth is proportional to the supply of the factors A and B in the diet, if all other factors are in proper proportion. For this reason the individual behaviour of the organisms to which these factors are administered cannot be eliminated.

3) Is the requirement of either A or B for maintenance or growth less when one of the two unknowns is present in liberal amounts, than when both are supplied in amounts near the minimum? — The experiments showed definitely that the animal can tolerate small quantities of A and B much better when the rest of the diet is well proportioned than when it is well constituted.

4) What is the effect on the health of animals of limiting them to a minimum supply of either the dietary A or B, the remaining one being supplied in abundance, or of limiting the supply of both to nearly the minimum requirement? — The life of the animals is undermined and endangered if the experimental conditions are such as to render growth impossible. The symptoms preceding the death of rats are similar to the characteristic symptoms of polyneuritis in pigeons.

378 — **The Biological Efficiency of Potato Nitrogen.** — ROSE, MARY S. and COOPER, IRENE F. (Department of Nutrition, Teachers College, Columbia University, New York), in *The Journal of Biological Chemistry*, Vol. XXX, No. 2, pp. 201-204. Baltimore, June, 1917.

A woman was submitted for 10 days to a diet of potatoes and clarified butter, which was sufficient for the total calorific energy. In this diet the potatoes supplied 0.1 % of the total nitrogen and nitrogen balance was maintained for 7 days (from the 4th to the 10th day of the experiment), with a total nitrogen intake of 0.096 gm. per kilo of live weight, equivalent to a net intake of 0.068 gm. per kilo of live weight. This result agrees with those of other workers, in which nitrogen equilibrium was maintained on potato nitrogen when the amount taken was from 0.04 to 0.08 gm. per kilo, and shows that the potato is a source of nitrogen of high food value, although only 63 % of the nitrogen is in the form of protein.

379 — **Food Value of Wholemeal and of 85 % Flour as Compared with White Flour.** — LAPICQUE, L. and CHAUSSIN, J., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 7, pp. 300-302. Paris, February 18, 1918.

The authors carried out a series of systematic experiments to determine the value of 80 and 85 % flours.

1) — **FOOD VALUE OF WHOLEMEAL.** — The experiments showed the food value of wholemeal to be slightly greater than that of its weight of white flour minus the weight of the indigestible residue. Average wheat gives 12 % of such residue and its food value is equal to  $9^{80}/_{100}$  of its weight of white flour. The so-called work lost by the mastication, mixing and intestinal transport of this excess of inert substances causes no deduction in this case as the figures are based on the value for the maintenance of the organism.

2) — **COMPARATIVE VALUE OF WHITE BREAD AND BREAD MADE WITH**

85 % FLOUR (treated with lime water) (1). — The difference in value between the two breads studied was too slight to be seen. With a mixed diet this difference could not be detected.

If the changes which may arise through the acidity of the bread (2) are eliminated, and the differences caused by the formation of hydrates are avoided or compensated for, 85 % bread has practically the same food value as white bread.

380 - **Toxic Bread and Flour; Detection and Estimation of Sapotoxins.** — STOECKLIN, L., in *Annales des Falsifications et des Fraudes*, Year X, Nos. 109-110, pp. 561-572, 1 fig., 2 Diagrams. Paris, November-December, 1917.

The 85 % war bread has again raised the serious question of injurious flours made from uncleaned or badly cleaned wheat which contain a large proportion of foreign grains, some of them very toxic. A long time ago, when cow-wheat was a very common weed, there was in France an epidemic which was attributed to the presence of this grain in the bread. Now there are cases of another disease caused by corn-cockle, which, however, is harmful in a different way from cow-wheat. The presence of 4 gm. of corn-cockle, *i. e.*, about 200 mgm. of sapotoxins (toxic glucosides of the "saponin" type), may cause very marked disorders in adult human beings. Animals are, as a rule, much less sensitive to the effects of corn-cockle than man; it has no effect on sheep or rabbits, and may be used as a normal food for them, but 250 gm. of it will kill a calf (3).

Of all the foreign grains liable to become mixed with wheat, corn-cockle is the most dangerous, the more so because, by reason of its similarity to wheat in weight and size, it is difficult to eliminate. Public bodies made the seriousness of this danger known as soon as 85 % flour came into use, and, by a circular letter addressed to the Director of the Laboratories of Adulteration, and another to the agents of the Service for the Prevention of Fraud (dated August 17, 1917), the Minister of Agriculture gave instructions for distinguishing flour from badly cleaned wheat and the penalties to be imposed on those responsible. These instructions order to seek for and retain as:—

1) fraud, being not of the nature and quality demanded of the article sold (a fraud dealt with by Article 1 of the law of August 1, 1905), all flour containing an excess of foreign, but not dangerous, grains;

2) "injurious to health", with application of the regulations of Article 3 of the law of August 1, 1905 (which orders imprisonment for a period of 3 months to 2 years, independently of a fine of 500 to 10000 fr. (£20, to £397), flour containing impurities made up of dangerous grains the presence of which renders the flour toxic in the sense of the above-mentioned law.

It is easy to detect particles of corn-cockle in flour but a quantitative estimation is very difficult. The author based his method for the detection

(1) See R. Jan., 1918, No. 3, and Feb., 1918, No. 216. — (2) See R. March, 1918, No. 344. — (3) See also R., Nov. 1916, No. 1191. (Ed.)

and estimation of sapotoxins in flour on the capacity of the saponins to haemolyse red blood corpuscles (as in his research into the saponins of beer in 1911). His results were conclusive.

In toxicology the saponins are placed in the class of the so-called "haematic" poisons which act on the corpuscles and plasma. They are poisons of the circulation, especially of the heart and nerves, capable of causing irritation of the mucous membranes and serious digestive troubles. The sapotoxins haemolyse the blood, *i. e.* destroy the globules with formation of a red, perfectly clear and transparent liquid by the setting free and solution of the haemoglobin; it is an haemolysis caused by toxic injury.

The haemolytic reaction is specific for the detection of the sapotoxins of flour in an isotonic medium, *i. e.*, with a freezing point about  $0.56^{\circ}$  C. (most satisfactory in 0.95 % physiological salt serums), in very small quantities at ordinary temperature, using an emulsion of blood corpuscles freed from fibre and plasma (natural antihaemolysins), and avoiding all accidental causes of haemolysis (which may be controlled by making a test with a saponin-free flour).

REAGENTS. — Two reagents are required for the reaction : — 1) an artificial 0.95 % physiological serum ; 2) a 10 % blood emulsion (human blood, blood of oxen, sheep, horses or sheep) fulfilling the conditions given above.

METHOD : — I. DETECTION OF SAPOTOXINS IN FLOUR.

1) *Freeing the flour from fat* by extraction with dry ether.

2) *Extraction of sapotoxins* : — 1 hour in the hot-air oven at  $100^{\circ}$ , cooling, addition of physiological serum ; 1 hour at  $40-45^{\circ}$  with frequent shaking ;  $\frac{3}{4}$  hour in the centrifuge ; filtration.

3) *Haemolytic reaction* : — the blood reagent is added to the extract obtained ; if the liquid becomes transparent sapotoxin is present ; the duration of the reaction varies from a few seconds to several hours, the more sapotoxin there is present, the shorter it is.

II. QUANTITATIVE DETERMINATION : — The rate of haemolysis is dependent on : — 1) the concentration of the sapotoxins ; 2) the temperature of the reaction ; 3) the nature of the blood ; 4) the age and concentration of the blood emulsion. There is a mathematical relation, which may be expressed by a regular curve, between the speed and concentration, all other conditions being equal. The author has drawn up diagrams giving an idea of speed in relation to concentration which are often sufficiently approximate for practical use ; nevertheless, for an exact analysis, it is best for the worker to compare the types and draw his own curve.

381 — **The Prevention of Malta Fever by Active Immunisation of Animal Carriers.** — VINCENT, H., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 8, pp. 359-362. Paris, February 25, 1918.

Malta fever, caused by *Micrococcus melitensis*, originally considered to be restricted to Malta and Gibraltar, is in reality found in many countries, particularly those bordering on the Mediterranean.

The animal which is most subject to this disease and most capable of transmitting it to man is the goat. There is every reason to believe that the active immunisation of the goat by *M. melitensis* is possible. As a

rule this animal only shows slight morbid symptoms, although it harbours the pathogenic organism for a long period. On the other hand, it may recover spontaneously from the disease after a variable period and, when recovered is immune. The author attempted to increase this natural resistance by vaccination with different strains of *M. melitensis*.

It is impossible to immunise the animals with a living virus, as that would cause infection amongst them; they must be vaccinated with a dead virus. The author prepared a polyvalent vaccine (gelatine cultures, 3 or 4 days old, diluted in physiological water, sterilised by shaking with ether and contact with it for 2 hours) with 10 strains of *M. melitensis* and one of *M. paramelitensis*. The vaccine contained about two thousand million micrococci per cc. Two injections of 2 cc. each were made at intervals of 5 or 8 days. A description is given of the experiments.

More than 200 young and adult goats were vaccinated; they included: —1) adult goats and he-goats; 2) kids 2 to 3 months old; 3) goats pregnant since 1 to 3 months; 4) goats in milk. No special symptoms were noted. After a few hours the injections caused a rise in temperature of 0.5 to 1°C.; the following day the temperature was normal. The goats kept their appetite. Those in kid suffered no bad effects, and pregnancy was not influenced by the injections.

This method of immunising goats and other animals capable of transmitting Malta fever by their milk or excreta or by direct contagion, may have the double effect of protecting these animals and, indirectly, man himself, against this serious disease.

382 — **Loss of Power of Infection of Marsh Anopheles during Hibernation.** — ROUBAUD, E., in *Comptes-rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 6, pp. 264-266. Paris, February 11, 1918.

Recent experiments have shown that not only do the salivary glands of marsh anopheles lose their sporozoites after a relatively small number of punctures, but that the sporozoites, if they have not been ejected, slowly degenerate in the tissues of the glands or the saliva. A prolonged conservation of the power of infection in infected anopheles does not seem possible. Unlike trypanosomic infection by *Glossina*, which generally lasts till the death of the infected fly, the salivary plasmodic infection of anopheles is only temporary. The saliva of mosquitos cannot, thus, be considered as an hibernation medium of malarial sporozoites.

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

383 — **Electric Farming in the United States.** — MOULTON, ROBERT H., in *Hoard's Dairyman*, Vol. LIV, No. 23, pp. 797 and 816, 3 figs. Fort Atkinson, Wis., December 28, 1917.

Experiments on electric farming (1) were made under the direction of Dr. HERBERT G. DORSEY and Mr. F. M. TAIT near Dayton, Ohio (Miami River Valley).

In the preliminary tests small plots were subjected to different kinds of electrification. To prevent the soil of one plot from being better than that of another, top earth was collected, mixed, sifted and then laid to the

(1) As regards Electric Farming, see R, Jan, 1918, No. 10 (Ed).

uniform depth of 7 inches over the whole area. In plot No. 1 was buried a wire screen, a wire network was stretched about 15 inches from the ground, and both connected by several wire antennae. The screen was connected to one terminal of a Tesla coil, and the network to the other. A transformer supplied an alternating current of from 110 to 5000 volts, charging a condenser of tinfoil and glass plate, which discharged through a primary of the coil. About 130 watts were supplied for an hour each morning and evening.

Plot No. 2 was lit by a 100 watt tungsten lamp with a ruby bulb for 3 hours daily, beginning from sunset. Plot No. 3 was lit in a similar way, but with a mercury vapour lamp. Plot No. 4 was untreated and served as control. In plot No. 5 was buried a wire network connected to the terminal of a 110-volt direct current. The positive terminal was attached to a small sprinkling can with a carbon electrode in its centre. The can was filled, the water electrolysed for several minutes, and the plot sprinkled with the water from the can, the theory being that the current should penetrate the soil in the water. Plots Nos. 6 and 7 were subdivided into four plots each 2 ft. square, separated by porcelain insulators and arranged with carbon electrodes at each end. Both direct and alternating currents were applied to these electrodes. Radishes and lettuce were sown and, when germination had begun, the different methods of electrification were tested with great care.

The plants in plot No. 1 grew much more rapidly than those of the other plots and weighed more than double those of the control bed. This convinced the experimenters that electrification of the ground by high-frequency currents stimulated plant life to an extent which justified a more complete investigation. Two acres of flat, rich ground were, consequently, selected for further tests.

Fifteen feet above the ground was built a network of sprinkling pipes, which ran east to west for a distance of 200 feet, the pipes being 50 feet apart. In the north-east corner, from north to south, were stretched 7 copper wires, each 200 feet long, at intervals of 15 feet. The wires were placed high enough for the soil to be ploughed with horses. The ends of the wire were attached to insulators on the top of gas pipes set in concrete. A small transformer house was built at the eastern end of the house and machinery capable of supplying 10 000 volts installed. A choke coil and a Tesla coil were used. The whole was so connected that the current from the wire network was sent by the antennae to the network of sprinkling pipes, which were adequately connected with the ground. Towards the end of July the system was ready and the currents tested. At that time a pressure of 50 000 volts was obtained and the frequency of the alternating currents was estimated at 30 000 cycles a second. Birds alighting on the wires were stunned and thrown to the ground, but none were killed. The ground was planted with radishes, lettuce, beet, cabbage, cucumbers, turnips, musk-melons, water-melons, parsnips, beans, peas, maize, and tobacco. All were planted in rows running from east to west, so that one half of each row was electrified and the other half not.

Practically all the plants in the electrified area grew more rapidly than those out of it. In nearly every case the electrified plants ripened a fortnight earlier than the untreated ones. The tobacco plants from the electrified area weighed, on the average, 1687 gm.; those of the unelectrified area, harvested two weeks later, only weighed 1632 gm. each. Considering that the tobacco plant grows most rapidly in the two weeks preceding ripening, it was estimated that the actual increase in weight of the plants in the electrified zone was 20 % more than that in the unelectrified zone.

Before electricity can be applied practically for stimulating plant growth many problems must be solved which are now being investigated in greenhouses in all parts of the United States. (The author draws attention to the experiments made by English workers who attempted to stimulate animal life by electricity. Two large incubators containing newly hatched chickens were taken, one being subjected to high-frequency currents, the other being used as a control. The chickens in the first incubator grew much more rapidly than the others).

Mr. W STAHL, an electrician, used electricity on plants on one of his farms near Chicago. A network of wires, from 10 to 20 feet apart, was placed in the earth at a depth of about 1 ½ feet; above the ground was another network of wires about 1 foot apart. Twice a day, morning and evening, the electric current was turned on from the main switch-board. The power was supplied by the city electric light plant, and the cost for the period necessary to ripen a crop was \$ 2.50 to \$ 4.00 per acre. The electric treatment was started just when the plant began to come out of the ground and continued till the crops were about ready to be harvested. The cost of installation is repaid by the increase in crops, and the cost of the current is more than compensated for by the saving in the cost of labour, and the more rapid growth and harvesting of the crop.

In 1917, Mr. STAHL gave a demonstration of the electric treatment of plants on a two-acre plot of his farm. He grew beans, tomatoes, beets, melons and other vegetables, which ripened much earlier than those on neighbouring farms, and allowed a second crop to be ripened before winter. The electrified plants are distinguished by their excellent quality.

## CROPS AND CULTIVATION

AGRICULTURAL  
METEOROLOGY

384 - Effect of Meteorological Factors on the Maturation of the Tissues and the Resistance to Cold of the Vine in U. S. A. — GLADWIN, F. E., *New in York Agricultural Experiment Station, Bulletin No. 433*, pp. 107-139. New York, April, 1917.

During the spring of 1916 Concord vines, at Fredonia, Kentucky, suffered severely from frost; a large proportion of the buds were killed, and many of the shoots dried up later.

An examination of the effects of meteorological factors on the growth of the vine, seemed to prove that the real cause of the damage is not the low temperature of spring, but rather the climatic conditions of the previous year, which prevent both the buds and the wood from maturing completely

before winter ; this may be seen from the low water content of the tissues and the thickening of the cell walls.

Abundant rain and high temperature up till the beginning of October followed by a sudden drop in temperature, are conditions favourable to good development of the tissues, which continue to produce thin-walled, turgescient cells, until the sudden cold stops growth and brings about the winter stage before the buds and wood are mature. It is rare that all the buds mature completely ; generally the first 5 or 6 on the base of the cane, and those near the apex are incompletely mature, and are clearly the most sensitive to adverse weather conditions, in winter and especially at the beginning of spring, *i. e.* when growth re-starts.

Maturity of the wood and buds is probably correlated with the ripeness of the fruit as measured by the sugar content of the juice. The meteorological conditions which determine complete ripening of the fruit also determine ripening of the fruit and buds. The 1914 crop was above the average, the grapes ripened completely, so did the plant tissues, as is shown by the low number of buds destroyed by the spring frosts. If the meteorological data of 1914 are compared with those of the year 1915-1916, two factors are seen :—

1) In 1915, many clouds, abundant rain and large number of wet days in August, September and October retarded evaporation, so that the soil was continually wet.

2) In 1915, September was much warmer than in 1914, a difference of 3.2° F. in the average daily temperature. The moisture of the soil and the warmth favoured late growth of the wood and retarded its ripening as well as that of the fruit.

3) In 1916, a high percentage of buds was destroyed in some varieties, whereas in others they were totally destroyed. The damage was not limited to certain districts but spread over the whole grape-belt. The abnormal warmth towards the end of January and the March frost alone would certainly not have had such disastrous effects if the incomplete maturity of the wood and the buds had not decreased the resistance of the plants to cold.

According to experiments made by the author, various types of fertilisers, nitrogenous, phosphatic and potassic, have no influence on maturity, and cannot, therefore, lessen the effect of low temperature.

To estimate the damage suffered during the season winter-spring 1916, 146 different vines were examined and the percentage of buds destroyed on each was calculated. All the plants were not damaged to the same extent and they could be divided into 3 groups as follows :

GROUP I. — *Least damaged vines* : 10 to 20 % of the buds destroyed : Mission, 10 % — Noah, 12 % — Cottage, 13 % — Moor Diamond, Hubbard, 14 % — Aroma, Dracut Amber, Woodruff, 15 % — Little Wonder, 16 % — Barry, 17 % — Concord, 18 % — Pocklington and Beta, 19 % — Martha, No. 264, 20 %.

GROUP II. — *Most damaged vines* : 80 to 100 % of the buds destroyed : Empire State and Dewdrop, 80 % — Brighton and Ontario, 82 % — Green Ea, 83 % — Diana, 86 % — Secretary, 88 % — Station No. 939, Dod Ridge, *Vitis Berlandieri*, 90 % — Ulster and Eu-

model, 92 % — Delakins and Dutchess, 94 % — Isabella, 95 % — Captivator, 96 % — Lady Washington, Armalaga, Westfield, No 3 516 : 99 % — Herbemont, Mills, Black Eagle, Rebecca, Nos 267 and 268, 100 %

GROUP III — *All the other vines examined* : 21 to 79 % of the buds destroyed.

To what is the difference in susceptibility of the various vines due ? First of all, it is seen that different varieties of the same species in no wise show the same degree of resistance. In the *Labrusca* varieties the damage varies from 13 % for the Cottage variety, to 78 % for Wyoming, the *Riparia* varieties vary from 12 % for Noah, to 88 % for Secretary, the *Aestivalis* varieties from 22 % for Wine King to 94 % for Dutchess. As a whole the *Aestivalis* group is more susceptible than the *Riparia* group or the *Labrusca* group, which is the most resistant. The *Labrusca* × *Vinifera* hybrids vary from 15 % for Woodruff to 100 % for Mills and Rebecca, the degree of resistance increasing in proportion as the characters of *Labrusca* predominate. It has been proved that, in New York State, the *Vinifera* varieties cannot survive the winter. Pure *Riparia* varieties have proved fairly resistant (Gloire, 29 % and Grand Feuilles 21 % of damage), and so have the *Rupestris* varieties (St. George, 29 % ; Mission, 10 %)

The above data shows clearly that certain species, as well as certain varieties of the same species, are more resistant than others, and capable of ripening their wood and buds more rapidly. The texture of the wood varies in different species and varieties of vine, but, so far, there have been no investigations into the possible correlation of wood hardness and resistance to cold.

385 — **Vegetation as an Indicator of the Fertility of Sandy Pine Plains Soils in Northern Wisconsin.** — DUNNEWALD, T J, in the *Journal of the American Society of Agronomy*, Vol. X, No 1 pp. 19-23, 5 tables, 1 diagram Lancaster, Pa., January 20, 1918.

While making a survey of part of northern Wisconsin it was noticed that the soils of sandy plains varied considerably in their ability to produce a second growth after the removal of the pines and the many severe fires which succeeded logging operations.

The most sandy portions, where the original timber was sparse, or consisted chiefly of Norway pine (*Pinus resinosa*) and Jack pine (*P. Banksiana*), with, perhaps a few white pines (*P. Strobus*), now bear little or no second growth. Small Jack or Norway pines, 6 to 10 ft. high, appear in clumps, and the poplar brush, if any, is also less than 10 ft. high, while a thick growth of sweetfern (*Myrrhis odorata*), bracken (*Pteris aquilina*), blueberries (*Vaccinium corymbosum*), or coarse bunch grass (*Elymus* sp.), is the only ground cover. In other places, where the moisture conditions appear somewhat better and the soil slightly more loamy, the second growth is often 20 to 40 ft. high, and consists of poplars, white birch, cherry, alder, and young white pine, with but few Jack or Norway pines. The original timber here had also been of better quality, mostly large white and Norway pines.

In this botanical examination of soils on the basis of their value for agricultural purposes, the most sandy soil was considered to be of low



value for farming, while the more loamy soil (indicated by the vegetation and better moisture conditions) was classed as fairly good. Typical samples were taken from widely-separated areas of these two soils, and mechanical and chemical analyses made. The results show that the soils with a small or sparse second growth should be classed as coarse or medium sand, whereas those with strong second growth should be classed as fine sand. The second type contains about the same amount of fine clay as the first, but much more silt and, particularly, much more fine sand. The averages of the principal fertilising elements in the different soils are given below: —

	Coarse sands			Loamy and fine sands		
	Phosphorus %	Potassium %	Nitrogen %	Phosphorus %	Potassium %	Nitrogen %
Soil (top 8 inches) . . .	0.048	1.12	0.071	0.055	1.05	0.081
Subsoil . . . . .	0.032	1.06	0.037	0.037	1.13	0.035

The coarse sandy soils contain 0.82 % calcium, the loamy and fine sandy soils 1.16 %. It is seen that the greatest difference in the food elements of the soil of the two groups is in the phosphorus; both the types are poorer than other classes of soil containing finer material (clay and silt).

The moisture equivalent (determined by letting each sample absorb as much water as it will hold, then subjecting it to centrifugalisation at 2 440 revolutions per minute for 40 minutes, and determining the percentage of moisture after treatment) was: — *coarse sands*: — soil, 14.92; subsoil, 9.48; *loamy and fine sands*: — soil, 19.40, subsoil, 13.76; *i. e.* the fine sands exceed the coarse ones by about  $\frac{1}{3}$  (27 %) for this important factor.

In conclusion it may be said that the undergrowth of cleared woodland is a good indication of the cropping capacity of the soil; heavier growth shows a higher content of plant food, the presence of more fine material in the soil, and especially a greater moisture-retaining capacity, enabling the vegetation to resist drought.

386 — **The Growth of Sheep Sorrel (*Rumex Acetosella*) in Calcareous and Dolomitic Media, in the United States.** — MACINTYRE, W. H., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 29-31, 1 plate. Lancaster, Pa., January 20, 1918.

The work described was carried out at the Agricultural Experiment Station of the University of Tennessee, by Dr. J. I. HARDY, under the direction of the author.

In 10 pots was placed a mixture of clean sand and limestone (92 %  $\text{CaCO}_3$ ), and in 10 others a mixture of sand and dolomite (about 50 %  $\text{CaCO}_3$  and 35 %  $\text{MgCO}_3$ ). The percentages of limestone and dolomite used were 100, 75, 50, 25, 15, 5, 2.5, 1, 0.5, 0. Eight stolons of equal size were placed in each pot with lime on June 13, and harvested, with their roots, on September 22, 1913 (101 days of growth), and in each pot with dolomite on March 31, and harvested July 8, 1914 (99 days of growth). The results, given in the appended table, show that sorrel (usually considered to indicate

a lack of lime in the soil) can grow well in a strongly alkaline soil. The photographs which accompany the paper show that the roots developed vigorously even in the presence of considerable quantities of limestone and dolomite.

*Weight in grams of whole air-dried sorrel plants, grown in pots containing varying percentages of limestone and dolomite.*

	Pot number									
	1	2	3	4	5	6	7	8	9	10
Sand + limestone. . . . .	1.61	0.42	1.06	1.91	0.75	1.83	1.48	1.24	0.51	1.82
Sand + dolomite . . . . .	3.34	6.54	1.20	1.51	1.38	1.02	1.57	3.96	3.87	1.60

387 - **Movement of Soluble Salts Through Soils** (1). — MC COOL, M. M. (Professor of Soils) and WHEETING, L. C. (Instructor in Soils, Michigan Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 11, pp. 531-547, 16 Tables, 5 Figs. Washington, December, 1917.

The principal work on this subject is first reviewed :—

1) MUNTZ and GAUDECHON concluded that, in rather dry soils, certain fertilizer salts take up water from the surrounding soil and remain for a long time localized in the moist area ; in somewhat moist soils this movement does not take place, and, even in moist soils, the diffusion of the salts is very slow on account of the discontinuity of the soil mass.

2) MALPRAUX and LEFORT, who studied the movement of nitrates in sandy and loam soil respectively showed that, both horizontally and vertically, the salts diffuse very slowly.

3) DEMOLON and BROUET showed that salts have a general tendency to remain at the surface of the soil and that rather large amounts of rain are required to carry nitrates into the subsoil.

The authors then describe the new experiments they carried out to control the results hitherto obtained ; one series was made with fine-textured soils, and a second with coarse textured soils. Their principal results may be summarised as follows :—

1) In moist soils the soluble salts move from regions of high to those of lower concentration. The movement is rather rapid and the salts do not remain long localized as has been stated by previous workers. Moreover, the water content of the soil and the amount of salt present influence the rate of movement.

2) Where moisture is lost by evaporation the upward movement is more rapid than the downward movement in heavy soils ; in coarser soils, such as sand, the downward movement is slight. This explains why, during drought, the soluble salts are more exposed to loss by upward movement in sandy soils than in heavier soils.

3) Chemical analyses show that, as the salts move through the soil,

(1) See also R. 1916, No. 615. (Ed)

the solution in the various layers of soil changes in composition. These changes vary according to the physical nature of the soil. Thus, the addition of 1 % of sodium chloride caused, in the soil solution of sandy soil, a gradual increase in the calcium and magnesium content in the layers above that to which the chloride was added. In silt loam, however, the maximum magnesium and calcium content were in the second layer, and dropped sharply in the third and fourth layers. These changes in composition should have an important influence on the effects produced by the use of fertilizer salts.

4) The movement of soluble salts in the soils is brought about by diffusion as a result of the chemical reaction in the soil and by the movement of the water (1).

388 - **Total Nitrogen and Carbon (2) in Cultivated Land and Land Abandoned to Grass and Weeds.** — BLAIR, A. W. and MC LEAN, H. G. (New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. IV, No. 4, pp. 283-293, 1 Fig., bibliography of 18 publications. Baltimore, October, 1917.

The work already done on this subject proves beyond doubt that the nitrogen and organic matter of cultivated land are rapidly exhausted in spite of the addition of fertilisers and green manures. In uncultivated land, however, the loss is less, and, in some cases, there are pronounced gains. Although the loss of nitrogen in cultivated land is partly due to the crops, which absorb a certain quantity of it, and to drainage waters in which it occurs as nitrates, the information available is not very definite.

In 1913 and 1916 the authors determined the nitrogen content of a sandy-loam soil allowed to run wild from 1908 to 1916, receiving annually during that period 600 lbs. of dried fish manure per acre. The nitrogen content remained fairly constant, but the carbon content increased slightly from 1913 to 1916.

On the other hand, the average nitrogen content of adjoining crops under a five year rotation (maize, oats, wheat, two years of grass) was 0.02 % less in 1913 and 0.023 % less in 1916 than that of the corresponding uncultivated plots, and the carbon content 0.27 % less in 1913 and 0.30 % less in 1916.

Two cultivated plots which received no nitrogen and were used as controls, gave an average total of 196.13 lbs. of nitrogen in their crops during the nine years. From six plots treated with nitrogenous manure during the same period, an average of 329.94 lbs of the organic nitrogen applied was recovered.

It is thus clear that the percentage of nitrogen and carbon in cultivated soils decreases even when 600 lbs. per acre of dried fish manure are applied annually, whereas the percentage of nitrogen in uncultivated soils which have received the same organic nitrogenous fertiliser remains about constant. The experiments show that, in cultivated soils, nitrogen is the limiting factor, and the fact that nearly  $\frac{2}{3}$  of the nitrogen of organic nitro-

(1) Other work in the United States on the concentration of nitrates in the soil confirm these conclusions. See R. Feb., 1918, No. 129. — (2) See R., Jan., 1918, No. 8. (Ed.)

genous fertilisers is unaccounted for is not in favour of the use of commercial nitrogenous fertilisers of an organic nature if those of mineral origin are available.

- 389 - **The Effect of Different Salts on Ammonia Formation in Soil.** — KOCH, G. P. (New Jersey Agricultural College Experiment Station, New Brunswick), in *The Journal of Biological Chemistry*, Vol. XXXI, No. 2, pp. 411-413, bibliography of 5 publications. Baltimore, August, 1917.

It has been shown by TOTTINGHAM and SHIVE, using plants in nutrient solutions of controlled concentrations, that high concentrations of salts are injurious to plants, while the same combination of salts at lower concentrations does not retard their growth. Similarly, the writer, controlling the concentration of the solution, studied the effects of a 3-salt solution (the physiological balance in nutrient solution) upon the decomposition of dialysed peptone by a pure culture of bacteria and found the same effects. So, in order to avoid osmotic differences all solutions used in the work were made up to an osmotic pressure of 2 atmospheres.

Different combinations of magnesium sulphate, potassium sulphate and monocalcium phosphate were applied to 100 gm. of soil mixed with 155 mgm. of nitrogen (dried blood). The mixture was incubated for 8 days and the ammonia distilled off by the usual method.

The following results were obtained:

1) In combinations of the salts where monocalcium phosphate was present in only 0.1 of the total concentration, a considerable increase in ammonia formation was apparent.

2) When 0.8, 0.9, or all of the total concentration was supplied by monocalcium phosphate, the ammonia formation was approximately 26.0 % greater than when no salts were added to the soil.

3) Magnesium sulphate and potassium sulphate singly or in combination were toxic where no monocalcium phosphate was added to the combination.

- 390 - **Aluminium as a Factor Influencing the Effect of Acid Soils on Different Crops.** — HARTWELL, BURT L. and PEMBER, F. R., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 45-47. Lancaster, Pa., January 20, 1918.

Many workers have called attention to the injurious effects of the hydrolysis of aluminium salts, caused by the liberation of free acids, measured by an increase in the hydrogen-ion concentration. Hitherto these effects have been attributed to the increase in acidity only, and not to the aluminium.

For a number of years the Rhode Island Agricultural Station has attempted to ascertain why different varieties of plants vary so remarkably in their response to liming. For example, under the same conditions, liming may double or triple the yield of barley and have no effect whatever on rye. Nevertheless, the authors found that the addition of acid to ordinary nutrient solutions had as depressing an effect on rye as on barley seedlings. This shows that the toxicity of so-called acid soils is not due to the acid alone, as, if it were so, the effects on the two seedlings would be similar.

The aqueous extract of an acid soil, like the soil itself, affected the two kinds of seedlings very differently, thus showing it to contain a substance which was not present in the ordinary nutrient solution. Sterilisation, dialysis, partial distillation, etc., indicated that this substance was crystalloid. By evaporating the extract, igniting and dissolving the residue in acid, a culture medium was obtained which was much more toxic to barley than to rye. Besides the ordinary nutrients the residue was found to contain silicon, aluminium and chromium. Aluminium being present in large quantities a study was made of the effects of this element by itself, or in combination with silicon, chromium, and other substances. The results led the authors to doubt the hypothesis that acidity is the only, or the main, factor influencing the growth of plants in acid soils.

When an amount of aluminium sulphate equivalent to that found in the soil extract was added to the culture medium, the barley seedlings suffered much more than the rye, but when the same amount of sulphuric acid without aluminium was added the rye suffered as much as the barley. The hydrolysis of the aluminium sulphate gave a hydrogen-ion concentration equal to  $\frac{1}{4}$  only of that obtained with the equivalent amount of free acid. The aluminium sulphate must thus have been the principal cause of the depression in the growth of the barley, and have had a much smaller effect on rye. In other words, the nutrient solution containing the aluminium had the same effect as the aqueous extract of an acid soil.

If aluminium is an important factor in the injurious effects of acid soils, any treatment which renders it less active will prove beneficial. A moist acid soil, upon which most plants died, was thoroughly mixed with the extraordinary amount of 28 tons per acre of acid phosphate, and after two weeks lettuce was planted. This crop could not exist in the untreated soil supplied only with nutrients, but in the soil treated with acid phosphate it gave a maximum crop, exceeding even that obtained when lime was used instead of phosphate.

It was shown that, for a considerable time, the large amount of acid phosphate greatly increased the acidity, yet a crop which usually responds well to liming made its maximum growth on a very acid soil without the addition of lime. The solubility of the aluminium in dilute acetic and carbonic acids had been markedly reduced by the phosphate, as it undoubtedly would have been by lime or lime and phosphate.

The determination of the "active" aluminium may, therefore, prove as useful as the determination of the acidity, and the lime requirements of a soil may be due to the need of lime to precipitate the toxic aluminium just as much as to the need of lime to neutralise its acidity. Indeed, it was found that after sufficient hydrated lime had been added to produce a maximum crop of lettuce, the soil still had, at the end of the vegetation experiment, a lime requirement equivalent to 4 000 to 5 000 lbs. of calcium oxide per acre, in spite of the fact that nearly all the lime had reacted with the soil.

391 — **Nitrates and Nitrification in Relation to Cultural Practices and Plant Growth.**

— NOYES, H. A. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol. 1, No. 1, pp. 38-39. Baltimore-London, February, 1917.

Soil bacteriological studies were carried out in an experimental orchard cultivated in different ways — clean culture with cover crop; unploughed, with grass cut and heaped round the trees; unploughed with grass cut and left where it falls. The aims of the experiments were:—*a*) to determine if the behaviour of the trees can be correlated with the activities of the bacteria in the soil; *b*) to determine the effect of this activity on the soil itself.

The results are summarised in the appended table; one season was dry, the other wet.

*Yearly nitrates, nitrification and tree growth (averages of 2 years).*

Data	Unploughed with straw mulch	Clean culture with cover crop	Unploughed		
			Grass cut and piled		Grass cut and left where it falls
			Hillside	Upland	
Circumference gain of trees (cm) . . . . .	5.67	5.10	4.47	4.34	3.55
Nitrates in field (per million) . . . . .	155	432	54	50	49
Nitrates after 6 weeks' incubation (per million). . . . .	1624	1443	2756	1484	1511
Nitrification (per million) . . . . .	1519	1011	2202	1433	1462
Field nitrification (%), . . . . .	17.5	33.5	9	6.5	8

From the results it is seen that: —

1) The nitrates in the field correlate with tree-growth (circumference gains);

2) A lower field nitrate content does not imply lower nitrate content after incubation;

3) The field nitrates, when compared with the nitrates after incubation, give the nitrifying efficiency of the organism under field conditions.

Knowledge of the nitrate content of field soil may throw more light on the activities of nitrifying bacteria than the nitrification test itself.

MANURES  
AND MANURING

392 — **Nitrification as a Measure of the Availability of Different Forms of Calcium Carbonate when Employed as Correctors of Soil Acidity.** — BURGESS, P. S. (Hawaiian Sugar Planter's Experiment Station, Honolulu, T. H.), in *Soil Science*, Vol. IV, No. 4, pp. 327-336, bibliography of 3 publications. Baltimore, October, 1917

Finely ground coral limestone and coral sand were examined for their use as fertilisers; both are identical chemically and only differ in their physical characters. They were applied to acid Hawaiian soils in quantities sufficient to neutralise the acidity. The mixtures were incubated for 20 weeks, and the nitric nitrogen content determined every two weeks. For purposes of comparison similar quantities of the mixture were incubated with the addition of dried blood or ammonium sulphate.

Similar results were obtained with the two lime fertilisers only when no other addition of nitrogen to the soil was made. When another fertiliser

was added, the finely ground coral limestone was  $1\frac{1}{2}$  times as efficacious as the best coral sand. Where no lime is added to the soil, nitrification is more abundant in the presence of dried blood than ammonium sulphate; but where lime of any description is added the reverse is true.

393 - **Changes Occurring During the Storage of Manure.** — RUSSELL, F. J. and RICHARDS, E. H. (Rothamsted Experimental Station), in *The Journal of Agricultural Science*, Vol. VIII, Pt. 4, pp. 494-503, 10 Figs. London, December, 1917.

After having discussed the previous work on the subject, the authors describe a series of investigations, carried out in the laboratory and on farms, which aimed at determining the changes produced in the manure heap, independently of the behaviour of the manure in the soil. To this end a study was made of the variations in the content in dry matter and combined nitrogen which occur during the storage of manure under varying conditions.

There is a great loss of free nitrogen, caused by the continual change from aerobic to anaerobic conditions in the heap and vice versa. The authors suggest that this loss is due to the fact that under anaerobic conditions there is a tendency towards the formation of molecular groups; these groups become unstable as soon as aerobic conditions are produced, or the converse occurs. It is known that, in contact with air, certain carbon compounds formed under anaerobic conditions may change into less complex compounds with elimination of the bivalent methyl groups ( $-\text{CH}_2-$ ). By analogy, therefore, certain complex nitrogen compounds may possibly change into more simple compounds, with liberation of nitrogen. The alternating nitrification and denitrification in the manure heap only represents a special case of this general phenomenon.

For this reason stored manure should be kept under as complete anaerobic conditions as possible, preferably at a temperature of  $26^{\circ}\text{C}$ . Experiments are being made to apply these conditions practically. However this may be, it appears certain that the custom of leaving the manure under the cattle in the stables or under open sheds, until required for use, is the best, wherever possible. No manure heap, however compact and well covered it may be, can fulfill the above conditions; perhaps they might be obtained by keeping the manure in water-tight and perfectly closed tanks at the given temperature. It seems improbable that ordinary manure heaps can be further improved.

394 - **The Problem of Potassium Salts in Italy.** — I. LEVI, M. G. Per l'industria dei sali potassici e del bromo. *Ministero per l'Industria, il Commercio e il Lavoro. Atti del Comitato per le Industrie Chimiche*, pp. 51-60. Rome, 1917. — II. MANZELLA, E. Le acque madri delle saline marittime e il problema dei sali potassici in Italia, *Annali di Chimica applicata*, Vol. VII, Nos. 1-2, 3-4, 5-6, and 7-8; pp. 1-27, 123-144. Rome, 1917. — III. LEVI, M. G. Per l'industria dei sali potassici e del bromo. *Relazione suppletiva. Ministero per l'Industria, il Commercio e il Lavoro, Atti del Comitato per le Industrie Chimiche*, pp. 61-63. Rome, 1917.

I. — The problem of potassium salts in Italy is above all an agricultural one, though many special chemical industries are also interested in it. Besides the German sources, there are others which in the future, may be-

come important, those of Kalucz in Galicia, Catalonia, Ethiopia, and doubtless others, but, as far as possible, the Italian agricultural problem should be solved independently of foreign mineral resources.

Good progress has already been made in Italy in the use of the carbon residue of sugar molasses, which, treated in large quantities, would without doubt yield an appreciable amount of salts. It has been proposed to use similar residues obtained by the evaporation and ignition of the lees of olive oil, but there appears to be some difficulty in the collection and transport of these products, of which there is a considerable quantity, spread over many different and large districts. The ash of plants is well used already, especially in soap factories. The investigations and experiments on the extraction of potassium salts from rock have not yet given quite satisfactory results (1). The sea may yet be used as a source not only of potassium salts, but also of bromine, sodium sulphate and magnesium salts, and in Italy, as for some time past in France, it has been considered as a source of potassium salts. This method would solve two problems at one time — the supply of agricultural potash and industrial bromine.

Italy is eminently a country of salt production. The amount of marine salt obtained annually exceeds 500 000 metric tons, and to this must be added rock salt and that obtained from salt springs. For many years the problem of the extraction of potassium salt from mother-lye of salt springs has been studied. Moreover, according to the communications of the General Office of State Monopolies of the Ministry of Industry, the investigations and experiments carried out since 1915 on the extraction of potassium salts for agricultural purposes from the mother-lye of salt springs has given fairly satisfactory results, and the Italian Office of Finance proposed to start the industrial production of these salts on a large scale from 1916. Work to this purpose is now being carried out at the salt springs of Sardinia from which a large quantity of suitable lye may be obtained.

II. — With regard to Sicily, information is given on the salt springs of Trapani, together with remarks on this product and the more rational use of the mother-lye, the greater part of which is re-circulated to improve the salt deposit of the concentrated "first waters". The volume of mother-lye available at 32.4° Beaumé per metric ton of salt would be 307.258 cubic feet in Sicilian salt springs. Applying this yield to the average salt production of the whole of Sicily a total of 3 789 130 cubic feet is obtained.

Taking this yield as a basis, it may be estimated that, in the other Italian salt springs, the volume of mother-lye available per ton of salt produced would be about 42.38 cubic feet corresponding to a total of 11 978 690 cubic feet.

Analyses of the mother-lyes of salt springs are given, and, after quoting the results obtained by BAIARD, USIGLIO, POHL, MERLE, CRUTI, ASQUINI and LACROIX, who, in water at 30° Beaumé per litre, found a potassium

(1) Though the possibility of leucite production in Italy is unlimited, the present yield is about 1 000 metric tons per annum. (Ed.)



content of 9.06, 18.73, 19.06, 7.69, 23.07, 22.51, 31.28 grams respectively, the author gives the results of an analysis he made of a sample of mother-lye at 31.4° Beaumé, taken from the salt springs of Ronciglio at Trapani. The results are as follows : —

Cations		gm. per litre
—		—
Sodium . . . . .		44.714
Potassium . . . . .		15 585
Calcium : small quantity not estimated . . . . .		—
Magnesium . . . . .		57 978
		118 277
Anions		
—		
Chlorine . . . . .		190 858
Bromine . . . . .		2 382
Sulphuric . . . . .		82.480
		275.729
Total · grams per litre . . . . .		394.006

If the various components were brought to their probable salt combinations the composition of the residue would be :

Sodium bromide . . . . .	gm.	3.067 per litre
Sodium chloride . . . . .	»	111.910 » »
Potassium chloride . . . . .	»	29.719 » »
Magnesium chloride . . . . .	»	146.168 » »
Excess of SO <sub>4</sub> considered to be combined with the calcium . . . . .	»	1.282 » »
Total . . . . .	gm.	394.383 per litre

Calculating the mother-lye at 30° Beaumé, the potassium chloride content would be 25.55 gm. per litre, and from the available mother-lyes of the Italian salt springs it would be possible to extract annually 258 398 cwt. of KCl and 21 205 cwt. of bromine. The 32 salt springs of Trapani which, for various reasons, are best suited for such extraction, would yield 48 427 cwt. of potassium chloride and 3 881 cwt. of bromine.

III. — The potassium deposit of Ethiopia is at Dancalia, nearly 10 miles from the frontier of Italian Eritrea. A little over a year ago a society with a capital of 2 million lire (about £ 80 000) was formed to work this deposit. The salt plain in which the deposit lies, is for the most part, a depression below sea level, and is the bed of an old sea, separated from the Red Sea by volcanic eruptions. The deposit has an area of about 482 square miles. At the surface is found very pure, 90-95 % potassium chloride. The lower layers are composed of 40 to 80 % chloride. Investigations and calculations show this deposit to have a capacity of about 2 million metric tons of 95 % potassium chloride, 140 000 tons of which are on the surface.

Near by there are also deposits of magnesium chloride, and sulphur including about 282 536 to 353 170 cubic feet of the latter. From February to November 1916 this society imported into Italy 2 500 metric tons of 95 % potassium chloride, and, from December, expected to import 1 000 tons monthly. It was certain of being able to supply Italian Agriculture with all the potassium salts required for 1917, and of being able to hold its own against all competition after the war. If this industry really develops as is expected it may cause a great change in the problem of potassium salts for Italy.

In view of a greater development of agriculture in Italy, of the need for bromine which will be felt in the new industries, of the possibility that the Ethiopian potassium chloride deposits will be unable to satisfy the need for potassium salts in Italy, and in view of the fact that changed conditions after the war will allow export trade in these products, the author considers that the extraction of potassium salts and bromine from the mother-lye of Italian salt springs should not be neglected. A careful and detailed financial, technical scheme for the formation in Sicily of works capable of dealing with 3 531 700 cubic feet of mother-lye per annum showed the estimated balance to be :

<i>Cost of Installation . . . . .</i>	<i>4 000 000 lire</i>
<i>Products obtained annually, not including mixed salts</i>	
and a possible production of sodium sulphate :	
39 368 cwt. of magnesium sulphate at 5 lire . .	100 000 »
67 894 cwt. of 80 % potassium chloride at 20 lire	700 000 »
3 937 cwt. of bromine at 400 lire . . . . .	800 000 »
<i>Total . . .</i>	<i>1 600 000 lire</i>
<i>Annual outlay (estimating the mother-lye at 1 lira per</i>	
<i>35.31 cubic feet) . . . . .</i>	<i>900 000 »</i>
<i>Net profit . . .</i>	<i>700 000 lire</i>

Admitting that these figures are estimated with excessive prudence, it is seen that the problem of the method to be adopted for treating the mother-lyes of Italian salt springs is worthy of most serious consideration by the government and manufacturers.

**395 - The Influence of Sodium Nitrate upon Nitrate Transformations in Soils with Special Reference to its Availability and that of other Nitrogenous Manures. —** COLEMAN, DAVID, A., in *Soil Science*, Vol. IV, No. 5, pp. 345-432 + 1 fig., bibliography of 226 publications. Baltimore, November, 1917.

After a full historical and critical review of the question, the author describes his own experiments on the influence of sodium nitrate on the transformations of nitrogen in the soil, by determining its effects upon the ammonification, nitrification, and nitrogen fixation capacity of seven different types of soil (1 very fine sand, 1 loam, 2 sandy loams, 1 clay loam, 1 muck loam, 1 silt loam). The hygroscopic moisture, apparent specific gravity, water-holding capacity, lime requirement, nitrate content and ammonia content of the soils were determined.

It seems certain that the addition of sodium nitrate increases markedly the simplification by hydrolysis of the protein molecules of the soil, for example, cottonseed meal is ammonified to a much greater extent than dried blood. On the other hand, acid phosphate increases the ammonification of dried blood, but potash, in the form of chloride, has little effect.

In alkaline soils sodium nitrate loses its stimulating action to a large extent as regards ammonification; this is due to the increased number of bacteria which assimilate the products of scission by hydrolysis, and to a rearrangement of the soil flora. It is the fungi of the soil which respond the most to applications of sodium nitrate, then the bacteria, the stimulating action of the nitrate being due to an anion.

As regards nitrification, the influence of sodium nitrate is greatest on dried blood, then on cottonseed meal, and, to a lesser degree, an ammonium sulphate, but when present in large quantities it decreases nitrification, and has a similar effect on the nitrogen fixation by *Azotobacter*. In amounts up to 5 000 lbs. per acre, sodium nitrate affects the activity of azotobacteria and azotococci in a similar manner, but in larger quantities it inhibits the activity of azotobacteria. The action of sodium nitrate is most detrimental to nitrogen-fixing bacteria, less so to nitrifying bacteria, and still less so to the ammonifying group.

In short, from the point of view of practical agriculture, sodium nitrate usually has a stimulating action on the activity of ammonifying and nitrifying microorganisms, but inhibits that of the nitrogen-fixing group. Nevertheless, if sodium nitrate is applied rationally there will be no danger of a toxic action, and there is reason to believe that the assimilation of soluble mineral fertilisers contributes to the recovery of the nitrogen supplied to the soil.

396 - **Experiments on the Bacterisation of Peat for Soil Fertilising Purposes.** — JONES, D. H. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol. 1, No. 1, pp. 43-44. Baltimore-London, February, 1917.

Peat bacterisation experiments were carried out with the object of verifying the claims made by Prof. BOTTOMLEY for "humogen" (1). Five 1 bushel lots of peat were taken; to three was added lime in varying quantities and they were then inoculated with rich broth cultures of soil bacteria; the 4th. lot was inoculated only with the same culture, and the 5th. kept as control. All were incubated at 25° C. for one month, moistened and aerated occasionally. They were then autoclaved for 1 hour, after which rich cultures of *Azotobacter*, *Pseudomonas radiculicola* and cellulose fermenting bacteria were added to all except the control, and the lots incubated at 25° C. for two months. Chemical tests and bacterial counts were made from time to time.

The different lots of peat thus obtained were mixed in 0.5, 2 and 10 percentages with a poor soil, the mixture placed in pots and radishes sown.

(1) See R. 1917, No. 714. (Ed.)

After 1 month the growth and greenness of the foliage was markedly in favour of the 10 % bacterised peat. After 3 months the results were, as a rule confirmed, both as regards growth of roots and of leaves, in favour of heavy applications of bacterised peat, up to an increase of more than 100 % in plant growth. The following results were obtained : —

Soil containing	Weight of roots	
	Bacterised peat	Unbacterised peat (control)
	gm.	gm.
0.5 % of peat . . . . .	39.33	35.5
2 % „ „ . . . . .	57.75	41.75
10 % „ „ . . . . .	135.25	63.25

The addition of lime had little, if any, effect.

To sum up, the bacterial treatment of peat seems to make the peat useful as a fertilizer, but the large quantities necessary to produce appreciable results excludes its general use as a fertiliser on account of the expense entailed.

397 — Fertiliser Applied to the Potato in Illinois, U. S. A. — See No. 416 of this *Review*.

398 — Irrigation in the Island of Cyprus. — See No. 376 of this *Review*.

PERMANENT  
IMPROVEMENTS:  
DRAINAGE AND  
IRRIGATION  
AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

399 — Studies on Inulin in Plants : I. Its Formation ; II. The Changes it Undergoes in the Resting Tuber of the Jerusalem Artichoke. — COLIN, H., in the *Comptes rendus des Séances de l'Académie des Sciences*, Year CLXVI, I. No. 5, pp. 224-227. February 4, 1918 and II. No. 7, pp. 305-307. February 18, 1918, Paris.

I. — The formation of inulin in plants is not yet well understood ; according to some authors, inulin is formed in the leaves, and then migrates unchanged into the roots or tubers ; others think that the inulin-storage organs only receive sugar from the leaves, the sugars afterwards condensing to form inulin.

Chemical examination of several inulin-containing plants, particularly the Jerusalem artichoke, has lead the author to believe that there is no question of the immediate elaboration of inulin by the leaves and its migration unchanged to the underground organs. It is osmotic pressure (MAQUENNE'S law) that controls the storage of inulin as it does the storage of saccharose ; the leaves only form sugars which are condensed either during their passage down the stem or only in the roots or tubers.

II. — Since 1867, DUBRUNFAUT (1) has recorded that Jerusalem artichoke tubers gathered in March give juice with a positive rotation, while those gathered in October give a decidedly laevorotary juice ; he attri-

(1) DUBRUNFAUT, *Comptes rendus*, Vol. LXXIV, 1867, p. 764. (*Author*)

butes that difference to the transformation of the inulin into crystallisable sugar during the rest period.

In reality, saccharose is always present in tubers undergoing formation, while the proportion is only augmented during the winter months.

DUBRUNFAUT thought that "inulin changed into two isomers, crystallisable cane sugar and an uncrystallisable sugar, optically inactive, and similar to that found in the fermentation of inverted sugar". This conclusion is not entirely justified; in fact, the direct rotation of the juice obtained in February to March is not more than  $+10$ ; correlatively, after inversion the rotation reaches  $-55$  at  $15^{\circ}\text{C}$ ; thus there exist at that period in the tubers, laevorotary principles, giving laevulose on hydrolysis, and which almost completely neutralise the positive rotation of the saccharose. These levulosanes differ greatly from the primitive inulin; their total rotatory power, ranging from  $-25$  and  $-30$ , is less than that of inulin ( $-40$  according to TAURET); but they can be hydrolysed by invertine and ferment, in consequence, in the presence of yeast. If sucrase is added to the juice of the Jerusalem artichoke, the reducers increase progressively while, at the same time, the power of rotation decreases; the saccharose is hydrolysed more rapidly than the levulosanes. All the carbohydrates are hydrolysed. When the juice is left standing in presence of an antiseptic, they transform spontaneously, but much more slowly.

These facts show why, in the distilling industry, Jerusalem artichoke tubers treated in October require a previous hydrolysis by acids, whilst those of tubers collected after winter may be fermented at once.

One part of the inulin changes, therefore, to *saccharose* in the tuber; the other part is degraded progressively to form levulosanes with an optical rotation lower, in absolute value, to that of inulin.

These phenomena are not limited to the Jerusalem artichoke; they also occur in chicory, in which they were observed by MM. WOLFF and GESLIN (1).

400 - Studies on the Cyanogenetic Compounds of Sorghum. — WILLAMAN J. J.: I. The Estimation of Hydrocyanic Acid and the Probable Form in which it Occurs in *Sorghum vulgare*; II. The Effect of Anaesthetics and of Frosting on the Cyanogenetic Compounds of *Sorghum vulgare*. *The Journal of Biological Chemistry*, Vol. XXIX, No. 1, pp 25-36, pp. 37-45. Baltimore, February, 1917.

I. — The methods generally in use for the estimation of cyanogenetic compounds in vegetable tissues (based on the hydrolysis of the cyanogenetic glucoside and the amount of hydrocyanic acid thus formed) are of doubtful accuracy, partly on account of the difficulty of obtaining complete hydrolysis with acids, partly on account of the partial retention by the tissues of the hydrocyanic acid during distillation, which is neither prevented by the addition of tartaric acid, nor diminished by distillation under reduced pressure.

*Sorghum vulgare* contains hydrocyanic acid in two forms: — a glucoside (dhuririn) and a non-glucosidic cyanide compound, the nature of which is

(1) See R., Dec. 1917, No. 1137 (Ed.).

as yet unknown. It is probably the latter which causes poisoning of live-stock. The best method of obtaining hydrolysis of the dhuririn is by autolysis, which occurs very rapidly at 45° C. The non-glucosidic cyanide may be separated from the glucoside by grinding the leaves in the presence of 5 % tartaric acid to prevent enzyme action and then distilling. By these means only the hydrocyanic acid from the non-glucoside substances is obtained; the latter are more unstable and decompose when boiled with a 5 % tartaric acid solution.

II. — Sorghum leaves exposed to the action of chloroform, ether, and alcohol, yield more hydrocyanic acid, both glucosidic and non-glucosidic, than normal leaves. The anaesthetics thus stimulate the hydrolytic as well as the synthetic action of the glucoside enzymes (this is a case of synthesis caused by enzymes *in vitro*). Enzyme powder prepared from chloroformed leaves was about 25 times as active towards amygdalin as the powder from untreated leaves. An examination of leaves which had been exposed to frost in the field and of leaves which had been subjected to a temperature of 7°C. showed that frost causes an increased yield of both glucosidic and non-glucosidic hydrocyanic acid. This is due partly to rupturing of the cells, and partly to disturbed enzyme equilibrium.

401 — **Analysis of Zamia Palm Nuts and Leaves.** — *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 12, p. 865. Sydney, December, 1917.

An analysis made at the Chemist's Branch of the Department of Agriculture of New South Wales gave the following results :

	Kernel	Leaves
Moisture . . . . .	81.79 %	76.67 %
Ash . . . . .	1.07	0.99
Ether extract . . . . .	0.18	0.21
Fibre . . . . .	4.74	6.18
Albuminoids . . . . .	0.03	2.64
Carbohydrates . . . . .	12.19	13.31

402 — **The Chemical Composition of the Potato Plant at Various Stages of Growth.** — See No. 415 of this Review.

403 — **The Growth of Isolated Plant Embryos.** — BUCKNER, G. DAVIS and KASTLE, JOSEPH, H. (Laboratory of Chemical Research, Kentucky Agricultural Experiment Station, Lexington), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 2, pp. 209-213. Baltimore, Md., March, 1917.

In their experiments the authors attempted to nourish embryos of Lima beans (*Phaseolus lunatus*), deprived of the cotyledons, with different compounds. Sugars (2 % solutions of glucose, saccharose, lactose, raffinose, mannite and maltose) caused growth, but starch or Hopkins' plant food had no influence. It has been shown that cotyledons which give no characteristic reaction for reducing sugars cause no growth, whereas the same cotyledons, when supplied with sugar, give a good growth. It was further

shown that the cotyledons of lima beans that have germinated and contain reducing sugars may also support the growth of an isolated embryo.

The results seem to show that growth of the embryo occurs wherever glucose or a carbohydrate giving a hexose on hydrolysis is present. When these substances are absent no growth results. It was further shown that the dry Lima bean does not contain the plant food necessary for the growth of its own embryo, but that the green cotyledons of a germinated bean do contain the food necessary for the normal growth of the plant.

404 - Variations in the Development of Secondary Rootlets in Cereals. — WALWORTH<sup>1</sup> E. H. and SMITH, I. H., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1<sup>2</sup> pp. 32-35, Lancaster, Pa., January 20, 1918.

The method adopted was to sow 100 or more grains from each variety studied in pots containing pure quartz sand, which were kept in a greenhouse. The secondary rootlets were counted when the plumule was from 1 to 2 inches high. The results, which confirmed those of Mr. R. G. WIGGANS (*Journal of the American Society of Agronomy*, Vol. 8, No. 1, pp. 31-37; 1916), showed that the number of secondary rootlets is by no means constant for a given variety, but varies with the individual, so that counts made from samples chosen at random usually give a frequency distribution represented by a fairly normal curve.

In *oats* the number of secondary rootlets varies from 0 to 5; each variety has a tendency to a high or low number of secondary rootlets, the number of frequency being 2 for some and 3 for others.

Of 11 varieties of *wheat* examined, 9 had a number of frequency equal to 2; in the two others it was equal to 4.

In *barley* the maximum number is 7, the number of frequency being 3 in some varieties and 4 in others.

The number of secondary rootlets is also variable in *maize*.

The range of variability is less in pure-line selections of oats than in the ordinary varieties. This is also true for wheat, with the exception of Turkey hybrid No. 509, which was more variable than the other selected varieties, perhaps because of its hybrid origin.

405 - The Selection and Hybridisation of Cereals in Alaska, U. S. A. — GEORGESON C. C. *Annual Report of the Alaska Agricultural Experiment Stations 1904-1915*. Washington, 1905-1916.

PLANT  
BREEDING

The introduction of the cultivation of cereals in the districts bordering on the arctic polar circle is of both practical and scientific importance.

In Alaska there is a great difference between the climate of the coast and that of the interior of the country. Along the Pacific, to the south of the high chains of the Alaska Range and of the St. Elias and Coast Ranges, the summer is cool, but the winter mild, so that at Sitka, for example, the average annual temperature is almost the same as that of Washington, D. C. In this district, the cool summers, abundant rainfall, and frequent clouds, are favourable to the growth of vegetables and grasses but unfavourable to that of ordinary crops, especially cereals, which do not ripen. In the interior, however, along the Yukon valley, between the coast Sierra

and the mountain groups of the southern sector (Endicott Range), the climate is decidedly continental, with dry, very cold winters and short summers, but nevertheless capable of causing rapid plant growth owing to the large number of hours of sun daily (18 to 20).

AGRICULTURAL STATIONS. — Alaska possesses 6 : —

1) *Sitka*, on the western coast of Baranof Island, a little above the 57th. parallel ; fruit trees and bushes are studied there.

2) *Kodiak*, on the eastern coast of Kodiak Island, near the 58th. parallel, concerned with animal husbandry.

3) *Kenai*, on Cook Inlet, near the 61st. parallel ; marsh plants, fodder plants and animal husbandry.

4) *Copper Center*, in the valley of the Copper River, about 100 miles from the coast. This Station, which dealt with cereals and marsh plants, was closed in 1909, and all the material received was transferred to *Fairbanks* and *Sitka*.

These four districts have a coastal climate, with mild winter but cool, rainy summers.

5) *Fairbanks*, in the Tanana Valley, a tributary of the right bank of the Yukon, near the 65th. parallel ; it deals with cereals, fodder plants, hoed crops, the breeding of resistant livestock for the interior.

6) *Rampart*, on the Yukon River, near the 66th. parallel ; it is the most northern station and is concerned with cereals and forage Leguminosae.

The two localities are in the district having a continental climate.

INTRODUCTION, ACCLIMATISATION AND IMPROVEMENT OF CEREALS IN ALASKA. — The work is organised as follows : —

1) *Acclimatisation experiments* of the greatest possible number of varieties from districts differing greatly from each other, situated especially in northern countries where the conditions for cereal growing are similar to those found in Alaska.

2) *Selection* : after the varieties capable of developing normally in the country have been determined, each is selected individually with a view to isolating lines having the most desirable characters, chief of which is earliness.

3) *Hybridisation* : in the successive individual selection, earliness is often accompanied by low yield, weak culms, etc. Attempts are made to obviate these faults by crossing early types with those which yield well and have strong straw, etc., so as to unite in one type the positive characters and eliminate the negative ones.

The work on cereals was first started at Kenai, Sitka, Copper Center, Fairbanks and Rampart, and then limited to the two last because at Sitka and Kenai, the wetness and low temperatures of summer prolong the period of growth to such an extent that the crops are exposed to the first, destructive, autumn frosts when, even under the most favourable circumstances, they have barely reached the milk-ripe stage. As has already been said, the Copper Center Station was closed in 1909. Varieties of barley and



oats have been tested at Sitka, rye and winter wheat at Kenai. The varieties tested were: —

- 1) *Barley*: — Erhard Fredenksen; Naked Barley S. P. I. 17 e. Section Plants Imported, U. S. Dept of Agric.) No. 20 909; Donnes Barley S. P. I. No. 20 608; G. I. 592 (from Norway).
- 3) *Oats*. — Erhard Frederiksen.
- 3) *Rye*: — Excelsior; Schlansted Techit'n.
- 4) *Winter wheat*: — Winter wheat; Yaroslaf

At the Copper Center Station, a little more inland, more satisfactory results were obtained than at Sitka and Kenai, and perhaps some varieties, especially of barley, could be grown successfully in the more sheltered parts of the Copper Valley. In any case precautions must be taken against summer frosts, which may destroy the crops completely, as occurred in 1908.

In the Yukon Valley the conditions peculiar to the northern climate oblige the selector to subordinate yield to earliness, so as to allow the varieties selected to complete their growth (from sowing to the ripening of the seeds) in the short interval of 70 to 90 days between the last spring frost and the first, destructive autumn frost. The results obtained for the different varieties of cereals were: —

1) *Winter wheat*, — Numerous varieties were introduced from the extreme northern countries — North Russia and Siberia, as well as the highest plains of the Himalayas. Mention may be made of the varieties Landomirka, Beloglina, Klondike (Canada), Pullman Hybrid No. 28, Wisconsin Pedigree No. 22, Bluestem, Pullman Hybrid No. 143, Pullman Winter Fife, Pullman Fortyfold. In the Upper Yukon Valley three climatic factors are very injurious to winter wheat: —

- a) the winter cold which kills the young plants;
- b) the alternate freezing and thawing in spring which heaves the plants;
- c) the early autumn colds which prevent ripening; the first destructive frost usually occurs towards the end of August.

Kharkov gave the best results of all the varieties tested. It is a slightly bearded wheat and a native of Russia introduced by the Federal Department of Agriculture. It ears in July and at least a part of the harvest always ripens completely by the beginning of September. In spite of its resistance to cold a large percentage of the young plants always die during the winter; for example, in 1913-1914, only 5 % of the young plants survived the winter. Winter cereals should be sown where the snow is thickest and lasts longest, so that it may protect the young plants, first against low temperatures, then against alternate freezing and thawing. In spite of nine years' selection the resistance to cold of the Kharkov variety has in no way increased, and, if the hybridisation experiments now in progress give equally negative results, winter wheat in Alaska will be superseded by rye, which is much more resistant to cold.

2) *Winter rye*. — Rye gave much better results than wheat. Whereas, in 1913-1914, 95 % of the young plants of Kharkov wheat were killed, the losses in the different varieties of rye varied from 10 to 25 %. The best of the many varieties studied were Excelsior, Amber, Giant

French, Brandon, Monster, No. 281, No. 1134, No. 12890, North Dakota, No. 959, Station No. 195, and Irkoutsk, all fairly equal as regards resistance to cold but differing largely in earliness. In 1914 the dates of ripening were:—

Irkoutsk, Giant French, Amber, No. 959, Monster,		
Station No. 195 . . . . .	August	12
Brandon . . . . .	"	14
No. 1134, No. 12890, No. 281 . . . . .	"	24

As regards *yield*, mention may be made of that given in 1914 at Fairbanks by the variety Winter Rye No. 19556, which, on a  $\frac{1}{8}$  acre plot gave a yield of 1520 lbs. per acre.

In Alaska the vegetative period of rye exceeds 13 months (1); it is sown towards the end of July and harvested at the beginning of September of the following year. It is, therefore, necessary to obtain varieties which ripen earlier so that the grain produced during the year may be used for sowing. The following hybrids are being tested:—Station No. 195  $\times$  North Dakota No. 959; Giant French  $\times$  Amber; North Dakota No. 959  $\times$  Giant French.

3) *Spring wheat*. — On the whole the results obtained with spring wheat are not very satisfactory. As sowing is not possible before May, there remain barely 90 days for ripening before the autumn frosts, so that the indispensable character required is earliness. None of the varieties studied ripen for certain each year, but the best were Chogot and Irkoutsk, the vegetative period of which lasted only 88 days (May 1st to August 27th) in 1914. These two wheats, introduced by the Federal Department of Agriculture, come from the Agricultural Station of Tulun (Government of Irkoutsk, Siberia). The Russian bearded wheat No. 306 is almost as early as these two, and the Russian wheat H. G., of vigorous growth, ripens four days later. Then come Ulka, Velvet Chaff, Ladoga, Red Fife, Romanov, Marquis, Early Java, which usually only ripen once in five years, as was the case in 1912 at Rampart, where the varieties Red Fife, Romanov and Wild Goose gave from 55 to 60 bushels of grain per acre.

The following crossings were made:—

a) Red Fife  $\times$  Saskatchewan; b) Chogot  $\times$  Saskatchewan; c) Chogot  $\times$  Velvet Chaff; d) Chogot  $\times$  Irkoutsk; the 1914 hybrids were no earlier than the parent plants, but the ears were larger and more compact, each spikelet containing 5 or 6 grains; e) Red Fife  $\times$  Ladoga; two yet unstable hybrids were obtained which still continue to split up into bearded and unbearded individuals, but they are earlier than the parent plants, thus fulfilling the aim in view.

4) *Spring rye*. — At Rampart, on May 1, 1915, were sown the three varieties Irkoutsk (from Tulun, Siberia), Gesselberg (from Tulun), and Mammoth. The first ripened on August 19. Gesselberg almost immediately after, and Mammoth ten days later. All the spring ryes were inferior to

(i) The abstract No. 635 of R. 1916 describes a variety of rye of the Upper Valley of the Dora Riparia (Italy) which remains in the ground for a period which may exceed 13 months. (Ed.)

the winter ryes in both earliness and yield. Attempts were made to improve them by selection and hybridisation. The cross Irkoutsk  $\times$  Mammoth gave, in the  $F_1$ , hybrids with well-filled heads and the earliness of Irkoutsk.

5) *Oats*. — Experiments have been made with many varieties of oats from northern districts, especially from Scandinavia, Finland, Russia and Siberia. The varieties which appeared most suitable were subjected to continuous individual selection with the purpose of developing the character "earliness". The best results were obtained with the varieties Finnish Black, Norwegian, South Dakota No. 637, Canadian 444 (from California), and Sixty Day, which ripen, on an average in 90 to 92 days, in time to avoid the first destructive frosts. Good results were also obtained with Copperfield, New Swedish, Hansen, Black Tartarian, and Banner, although they are a little late. The varieties Minnesota No. 261, Orlov, Ontario, Ruakura, Russian No. 409, and Beliak (from Yakoutsk, Siberia), have little chance of succeeding in Alaska.

Very little data on *yield in grain* is available. At Fairbanks in 1912, the varieties Sixty Day, Finnish Black, and Banner yielded 85, 90 and 100 bushels per acre respectively, whereas at Rampart, the yields were not quite half these amounts. It should be noted that all these figures refer to small, chosen plots, with the most favourable exposure possible.

Although the results obtained by individual selection and acclimatization with the varieties Finnish Black, Copperfield and South Dakota, leave very little margin for subsequent improvement, hybridisation experiments were carried out some of which gave absolutely positive results. Thus, for example, the hybrids 25 A-1 and 25 A-3, which ripen one day earlier than Finnish Black oats, give as many as 120 grains per head, and, in three years only, are sufficiently stable. Both are derived from the cross Copperfield  $\times$  Toholampi. Copperfield is a grey mutation from the Finnish Black variety, from which Toholampi is also derived by selection in pure lines.

6) *Barley*. — Owing to the relative shortness of its period of growth, barley is undoubtedly the cereal most suited to Alaska. Its yields in grain and straw are fairly high, and the nourishing grain, besides being an excellent food for cattle may also be used for making bread. The acclimatization experiments have given a large percentage of varieties capable of ripening completely. The best results were obtained with: —

*Pamir* S. P. I. No. 18922, a bearded barley, native of Central Asia, where it does well at altitudes of from 900 to 1300 feet, is one of the earliest varieties of barley of the world; at Rampart it ripens, on an average, 76 days after being sown, but yields little.

*Champion*, a beardless barley of very vigorous growth.

*Manshury*, also excellent, early productive, with strong straw, but long, stiff, sharp awns.

*Chittyna*, a beardless barley, productive and with strong straw, but too late; it was isolated in 1906 at Coldfoot, Alaska.

More or less satisfactory results were obtained with:

*Beardless* No. 19852; *Hull-less* No. 19851; *Uvjala* and *Finland* (both natives of Dickkursby, Finland); *Swedish* No. 19557; *Jakoutsk* G. I. 498 (native of Siberia); a Russian variety, S. P. I. No. 2786, which, together with a few others, resisted the terrible frost of July 21, 1908.

All the barleys studied were from northern countries, with the exception of Barbary G. I. No. 659, a native of North Africa which in 1911, at Rampart, ripened only one week later than the Pamir variety.

The hybridisation of barley, both in its scope and the results obtained, is much more important than that of other cereals. The three characters essential to a thoroughly satisfactory barley in Alaska are: —

- a) *Earliness*, for the usual reasons already mentioned;
- b) *Absence of awns*, as their presence prevents the feeding of barley in the ear to cattle;
- c) *Strong straw*, to resist lodging.

The best of the numerous hybrids obtained are: —

*Hull-less* S. P. I. 12 709  $\times$  *Swedish* S. P. I. 19 557. The second used as male parent, was chosen because of its earliness, but it has awns. *Hull-less* is a good variety in every way, but is late. The hybrids have slightly pointed glumes, and may be said to be beardless. They are nearly as early as Pamir barley (vegetative period = 80 days), and have very resistant straw.

*Chittyn*  $\times$  *Oderbucker*, a cross made in 1909. The descendants were mixed as regards the presence of awns, but in 1914, the percentage of bearded ears had dropped to 10-15%; and it is probable that, if selection is continued, a stable, beardless type will eventually be obtained. This hybrid gave good yields in grain and straw.

Many crosses were also made between the earliest barley, Pamir, and other satisfactory varieties. Four of these hybrids, now stable, ripen very quickly (towards the middle of August), and three are beardless.

CONCLUSIONS. — All winter and spring cereals may be grown in the valley of the Yukon and its tributaries, where the short, but relatively warm and dry summer, allows them to grow and ripen in the three months' interval between the last destructive spring frost and the first autumn one, *i. e.*, between the end of May and the end of August.

The first place is held by barley, some varieties and hybrids of which seem to unite in good proportions the most essential characters strong straw, high yield, and absence of awns (1).

406—The Inheritance of Glume Length in *Triticum polonicum*. A Case of Zygotic Inhibition. — BACKHOUSE, W. O., in the *Journal of Genetics*, Vol. VII, No. 2, pp. 125-133, 5 figs. Cambridge, 1918.

PUBESCENCE. — Polish wheat (*Triticum polonicum*) is characterised by long glumes, which may reach a length of 40 mm.; the average length is 29 mm., as compared with 10 mm. in ordinary wheat. The author (Economic Botanist to the Argentine Government), having noted in 1911,

(1) According to an approximate estimation there are, in Alaska, 30 000 square miles of tillable land. It is not easy to determine how much of this area is suitable to the different cereals nor is it possible to say whether it would be practical to produce cereals in competition with the neighbouring market of the United States. Nevertheless the results of the experiments carried out so far are of great importance for agricultural science and also because some of the selected varieties obtained by hybridisation might be advantageously introduced and acclimatised in the vast lands of Russia, Siberia and Canada. (*Ed.*)

that in a collection of varieties of *T. polonicum* belonging to Mr. PH. DE VIL-MORIN at Verrières (France), there were none with perfectly smooth glumes, and that, the shorter the glume, the more felted did it appear, proposed to study the influence of the length of the glumes on their pubescence. To this end he crossed, in 1912, a variety of *T. polonicum* having an average glume length of 29 mm., and very faintly pubescent, with a variety of *T. durum* called "Kubanka", a smooth variety with an average glume length of 12 mm. The first generation had glumes of intermediate length (18 to 19 mm.), and was much more pubescent than the parent *T. polonicum*.  $F_2$  had plants with fully pubescent ears.

The author divides the hybrids of  $F_2$  into 2 groups as regards length of glume :—

- 1) short glumes (homozygotes), 10 to 14 mm. long;
- 2) long glumes (homozygotes), 22 to 31 mm., and intermediate glumes (heterozygotes), 14 to 22 mm. long.

In  $F_2$  there were 172 long and intermediate plants, and 55 short ones; the theoretical numbers would be 170.25 and 56.75, corresponding to the Mendelian ratio 3 : 1. Of the 55 short-glumed plants, 40 were felted, 15 smooth; the theoretical numbers would be 41.25 and 13.75, according to the Mendelian ratio 3 : 1, showing predominance of the character "pubescence".

Considering the plants with glumes from 14 to 21 mm. long as heterozygotes, only 15 out of 85 could called really felted. The plants with long glumes (22 to 31 mm.) were all smooth, like the parent Kubanka.

Crosses between these plants with long glumes with the parent Kubanka sometimes gave, in  $F_2$ , a mixture of rough and smooth plants showing, in the short-glumed group, the usual ratio of 3 : 1.

These results show that, in *T. polonicum*, long glumes inhibit pubescence, so that they remain smooth in spite of the presence of the factor determining pubescence. To obtain felted glumes, the length must be reduced.

PIGMENTATION. — The same variety of *T. polonicum* (with glumes from 28 to 29 mm. long, whitish, smooth) was crossed with a variety of *T. turgidum*, derived from Rivet wheat, which it resembles (glumes 11 mm. long, black, felted).

The glumes of the  $F_1$  were intermediate in length (14 to 17 mm.), white, or slightly tinged, fairly felted. In the  $F_2$  there were 514 long or intermediate glumed plants, and 178 short-glumed ones; the theoretical numbers would be 519 and 173 in accordance with the Mendelian ratio 3 : 1.

The same phenomenon is observed in the coloration of the glumes as in their pubescence, except that the character "black coloration of glumes" is recessive. In the short-glumed group (8 to 13 mm.) of 178 hybrids, 129 were white or tinged and 49 coloured; the theoretical numbers, corresponding to the Mendelian ratio, would be 133.5 and 44.5. All the long-glumed hybrids were white or tinged.

It may, therefore, be concluded, that the length of the glumes has an inhibitory effect on their pigmentation.

407 - **Oat Selection by Pure Lines at the Agricultural Experiment Station of Highmoor, Maine, U. S. A.**—SURFACE, FRANK M. and ZINN, JACOB, *Thirty-second Annual Report of the Maine Agricultural Experiment Station*, pp. 97-148. Orono, Maine, 1917.

The work described was begun in 1910 at Highmoor Farm, with 146 plants chosen from 18 of the most common commercial varieties, each being used as stock for a pure line.

In 1915, the best material, from which the poorer types had been gradually discarded, was reduced to 12 lines:—

Maine Nos. 355, 281, 351, 230, 307, 286, 357, derived from the Banner variety;

Maine Nos. 340, 337, 336, 346, derived from the Irish Victor variety;

Maine No. 247, derived from the Imported Scotch variety.

As is seen in the appended table, the selection results were distinctly positive, *all* the pure lines being markedly superior to the original varieties Banner, Irish Victor and Imported Scotch.

*Yield in grain of the pure lines compared with the original commercial varieties.  
Averages from 1913-1915.*

Variety	Parent variety	Grain yield bushels per acre	Original commercial varieties	Grain yield bushels per acre
Maine No. 355	Banner . . . . .	86.6	Early Pearl . . . .	82.0
» No. 340	Irish Victor . . . .	84.5	Minnesota No. 26. .	81.6
» No. 281	Banner . . . . .	83.8	Banner . . . . .	79.7
» No. 351	Banner . . . . .	81.2	Gold Rain. . . . .	77.8
» No. 337	Irish Victor . . . .	80.5	Siberian . . . . .	77.2
» No. 230	Banner . . . . .	80.0	Prosperity . . . . .	76.4
» No. 307	Banner . . . . .	79.9	Irish Victor . . . .	75.2
» No. 336	Irish Victor . . . .	79.9	Imported Scotch. . .	73.2
» No. 346	Irish Victor . . . .	79.5	Kherson . . . . .	70.1
» No. 247	Imported Scotch. .	78.1	Swedish Select . . .	69.7
» No. 286	Banner . . . . .	77.9	Senator . . . . .	64.4
» No. 357	Banner . . . . .	77.4	—	—
<i>Average</i>		<b>80.8</b>	<i>Average</i>	<b>75.2</b>

As regards the shape of the panicle, the characters of the caryopsis, etc., the pure lines closely resemble the original varieties. The changes in physiological characters which result in higher yield are, therefore, not necessarily associated with morphological characters.

The selected types are not only distinguished by a high yield, but also by the regularity and uniformity with which they ripen, points not always found in commercial varieties, many of which give, at the same time, early plants, over-ripe at the time of harvest, thus losing their grain easily, and

plants which are still green at harvest time, thus reducing the yield, and giving a product of unequal appearance. In all the selected plants the vegetative period (from sowing to harvest) lasts, on the average, 106 days with a minimum of 103 for Maine Nos. 340 and 337, and a maximum of 109 for Maine No. 357.

By its yield, strong straw (almost totally resistant to lodging), and the weight of its grain (1 000 weigh 40.30 gms. as against an average of 37.72 gms. for the 12 lines), Maine No. 340 is the type best adapted to the soil and climatic conditions of Highmoor.

The highest net yield was given by the line Maine No. 355 (86.6 bushels per acre), which is distinguished by its low hull percentage (27.76 %, as compared with 28.45 % for the 12 lines). On the other hand, its grain is light (35.49 gms. per 1 000) and it is somewhat subject to lodging, especially in heavy soils.

The other lines, though excellent and worthy of further trial, are nevertheless inferior to the two above-mentioned types.

The experiments are being continued with the aim of : — 1) isolating further new lines ; 2) improving those already obtained by the removal of undesirable characters ; 3) determining in each case the districts in Maine and other states best suited to each of the types which is being selected and propagated.

408 — **Genetic Study on the Awns of a Variety of Six-Rowed Barley.** — IKENO, SEIITIRO, in *The Botanical Magazine*, Vol. XXXI, No. 370, pp. 263-267. Tokyo, October, 1917.

All the spikelets of the Japanese variety of six-rowed barley (*Hordeum sativum hexastichum*) known as "Kinukawa", have awns, which are longer in the central than the side rows.

To study the inheritance of these awns the author crossed, in both directions, the Kinukawa variety with another variety of six-rowed barley called "Noghenasi", generally beardless, but sometimes having, except on the upper part of the ear, median spikelets with very short awns.

In the  $F_1$  generation the hybrids Kinukawa  $\times$  Noghenasi and Noghenasi  $\times$  Kinukawa both had median awns shorter than those of the parent-plant Kinukawa, whereas the lateral awns, even in the same ear, varied considerably, being : — 1) very short ; 2) entirely absent ; 3) reduced to a slight prolongation of the glume.

In the  $F_2$  there were many forms : — 1) ear completely bearded ; 2) ear semi-bearded (awns on the median rows only) ; 3) lateral awns varying, as in the hybrids of  $F_1$ . Moreover, in each group, the length of the awns varied considerably.

In the  $F_3$  only 4 of the 321 plants of the  $F_2$  gave constantly bearded progeny (like the parent Kinukawa), and only 6 gave progeny constantly beardless (like the parent Noghenasi). The average between 4 and 6 gives the Mendelian ratio 5 : 321, equal to the ratio 1 : 64, observed in cases of tri-hybridism.

The author admits the presence of three factors, or genes, which he calls A, E, and I respectively. Even in the absence of these three factors (*i. e.*, in individuals having the gametic formula *aa ee ii*), two varieties

of very short awns (median and lateral) may develop, but the presence of either **A** or **E** increases the length of the awns, and the simultaneous presence of **A** and **E** gives them the maximum development characteristic of the completely bearded type, Kinukawa, which has the formula **AA EE II**. On the other hand, the inhibitory factor **I** prevents the formation of awns on the lateral rows, while the median rows have long awns, in accordance with the formula **AA EE II**.

In the beardless parent, Noghenasi, (with formula **aa ee II**), the factor **I** suppressed not only the lateral awns, but also, partially or totally, the median awns. By crossing Kinukawa (**AA EE II**) with Noghenasi (**ee aa II**), were obtained in  $F_1$  hybrids with the formula **Aa Ee II**, in which the shorter median awns and the different behaviour of the lateral awns are easily explained by the presence of **A**, **E** and **I** in the heterozygous state.

In the  $F_3$  there are 64 gametic combinations, which may be divided into three groups:—

1) *Completely bearded ears*, in which the factor **I** is entirely absent; they number 16:— 1 plant with the formula **AA EE II** (Kinukawa type); 2 **AA Ee II**; 2 **Aa EE II**; 4 **Aa Ee II**; 1 **AA ee II**; 2 **Aa ee II**; 1 **aa EE II**; 2 **aa Ee II**, 1 **aa ee II**.

2) *Semi-bearded or beardless ears*, in which the factor **I** is homozygous; they number 16: 1 **AA EE II**; 2 **AA Ee II**; 2 **Aa EE II**; 4 **Aa Ee II**; 1 **AA ee II**; 2 **Aa ee II**; 1 **aa EE II**; 2 **aa Ee II**, 1 **aa ee II** (Noghenasi type).

3) *Plants in which I is heterozygous*; they number 32:— 2 **AA EE II**; 4 **AA Ee II**; 4 **Aa EE II**; 8 **Aa Ee II**; 2 **AA ee II**; 4 **Aa ee II**; 2 **aa EE II**; 4 **aa Ee II**; 2 **aa ee II**.

The problem of the distribution of the  $F_2$  plants among these three groups may be solved by an examination of the progeny in  $F_3$ . It is clear that the plants of groups 1 and 2 will produce exclusively bearded and beardless plants respectively, whereas those of group 3, in accordance with the Mendelian laws, will give mixed progeny composed of both entirely bearded and semi-bearded forms. The results of an analysis of  $F_3$  were as follows:—

*Composition of the  $F_1$  generation.*

	Number of plants		Percentages	
	found	calculated	found	calculated
Group I . . . . .	69	80.25	0.9	1
Group II . . . . .	88	80.25	1.1	1
Group III . . . . .	164	160.50	2.0	2
Totals . . . . .	321	321.00	4.0	4

There is, therefore an almost perfect agreement between the figures found and those calculated.

It has already been shown above that of the 16 hybrids of groups 1 and 2 of the  $F_2$ , 4 hybrids of each group (*i. e.*  $\frac{1}{4}$ ) remain constant even in the  $F_3$ ; these are: **AA EE II**, **AA ee II**, **aa EE II**, **aa ee II**, (group 1); **AA EE II**, **AA ee II**, **aa EE II**, **aa ee II** (group 2), whereas, on the contrary, no plant



of group 3 remains constant in the  $F_3$  owing to the presence of the factor I as a heterozygote. Experiments on this subject gave the following results: —

Group I (69 individuals)		Group II (88 individuals)		Group III (164 individuals)	
Number of constant individuals		Number of constant individuals		Number of constant individuals	
found	calculated	found	calculated	found	calculated
21	$17.25 \left( = \frac{69}{4} \right)$	23	$22 \left( = \frac{88}{4} \right)$	0	0

CONCLUSIONS: — 1) Three factors A, E, I, are concerned, of which the first two are found in the bearded parent Kinukawa, and the third in the beardless parent Noghenasi. Even in the absence of these three factors *short* median and lateral awns may be formed, but in the presence of A or E the awns are longer and, in the presence of both at the same time, the awns may be as long as those characteristic of the variety Kinukawa.

2) The factor I is inhibitory; when homozygous it suppresses the lateral awns, but does not entirely prevent the formation of median awns, which are sometimes found even in the beardless Noghenasi plants of the formula aa ee II; when heterozygous, it produces a great variety of lateral awns, sometimes even on the same ear.

3) The great differences in the length of the awns is due in particular to combinations of the two factors A and E.

409 — “Reggiano Maize”, A New Variety of Early Dwarf Maize Obtained in Italy by Hybridisation and Selection. — SUCCH, A., in *Le Stazioni sperimentali agrarie italiane*, Vol. I, Pt. 9-10, pp. 401-432. Modena, 1917.

By continual hybridisation and selection work the author has succeeded in fixing and propagating a new type of early dwarf maize, called “reggiano maize”, which is much earlier and a better cropper than that used as original material. This original variety, obtained from seed imported from America, has been cultivated since 1894 in the province of Bologna, and since 1897 in that of Reggio-Emilia, the only selection being that of the best ears.

The author describes experiments carried out by him at the experimental fields of the School of Agriculture of Reggio-Emilia, taking into consideration the following characteristics: —

Yield, earliness, length of culm, height of insertion of the ear above the ground, total number of internodes, number of internodes below the ear, length of ear and of peduncle, number of rows of seed per ear.

Of the ears selected since 1912 from the early-flowering plants, numbers 3 and 7 gave the best results, owing to the stability of their characters. In the present hybridisation experiments possible reversion to unknown types which took part in the preceding natural crosses is avoided.

*Data obtained in 1914: averages of 10 culms.*

	Crossings made in 1914	
	3 ♀ × 7 ♂	7 ♀ × 3 ♂
Length of culm, in centimetres. . . . .	0.83	0.81
Height of insertion of ear, in centimetres. . . . .	0.23	0.28
Total number of internodes . . . . .	7.22	7.12
Number of internodes below the ear . . . . .	3.55	3.60
Length of ear, in centimetres . . . . .	17.33	16.37
Length of peduncle, in centimetres . . . . .	9.44	13.40
Number of rows of grain per ear. . . . .	14.70	15.25

The characters are not constant only in the products of the reciprocal crossings 3 ♀ × 7 ♂ and 7 ♀ × 3 ♂, but also in plants resulting from self-fertilisation, so that, by a suitable fusion of the characters of the parent plants, another type — “reggiano-maize” — stable, homogenous, and really superior, tends to separate out.

Below is a summary of the methods adopted by the author to intensify still more the selection of this new type starting from the reciprocal crossings 3 ♀ × 7 ♂ and 7 ♀ × 3 ♂:

A. — SOWING. — 1) Isolate the experimental fields with protective belts so as to prevent cross-fertilisation, using, to form these belts, giant Caragua white maize, which usually flowers a month later than early dwarf maize.

2) Sow on one line only the seed from each ear.

B. — DURING GROWTH. — 3) Suppress sterile plants before the opening of the anthers.

4) Castrate the male flowers, not only of all the plants to be used for hybridisation, but also of all weak plants, or those higher or later than usual.

5) At the time of flowering mark the best plants, choosing those which are earliest and strongest.

C. — AT HARVEST AND FOR THE HARVESTED CROP. — 6) At the time of harvest choose the earliest, strongest plants, most rich in ears, normal and without disease (about 5 feet long, with 8 internodes).

7) Choose the ears:—*a*) inserted the lowest, *i. e.* at 9.82 to 11 inches from the ground at the 4th. node; *b*) with a peduncle about 6 inches long; *c*) the thickest.

8) Keep the ears enclosed in their sheath for a few days.

9) Remove the sheath and choose the ears which:—*a*) are thickest; *b*) are most typical; *c*) are fullest, with well-plumped grain at the top; *d*) have the most regular rows; *e*) have the most numerous rows; *f*) show the best characters as regards number, size, colour and fullness of grain.

10) Choose the grains on the ears, discarding: — *a*) those of the tip and the base; *b*) the most irregular; *c*) the more or less aborted, often found between normal grains or those above the normal.

The new type obtained by these methods from seed imported directly

from America belongs to the species *A Zea Mays* Bonaf., Class I : early maize, group *a* : yellow maize. Its characteristics are : —

- 1) Long culm, averaging 3.28 to 3.60 feet, between the first non-rooted node, on the level of the ground and the joint node of the peduncle of the male inflorescence. Total length of the plant about 4.92 ft.
- 2) Number of internodes : — 8 to 9.
- 3) Number of leaves : — 9 to 10, with strong and well developed blade, sheath thick, causing a marked thickening at the level of the nodes.
- 4) Ear normal, joined at the 3rd. or 4th. node, at 9.82 to 11 inches above the ground, with peduncle about 3.93 to 5.90 inches long ; bare ear, about 6.68 to 6.86 inches long, slightly conical, rounded at the tip.
- 5) Grain a fine, bright yellow, arranged in 16 to 18 rows, weighing, on an average 40 gm. per hundred.
- 6) Rachis, firm.
- 7) Yield, slightly inferior to that of "Agostano" maize (63  $\frac{1}{2}$  cwt. per acre as compared with 66 cwt. for the latter, according to BENDANDI of the Modena Agricultural Station).

8) In the normal climate of the province of Reggio-Emilia, the new type, sown at the beginning of May, flowers in the second half of June, and ripens at the end of August.

Cultural tests made in 1912 to compare the new selected type with the original variety (seed from Bologna) confirmed the marked superiority of the new one as regards shortness and earliness ; its height is only 5 feet as compared with 6  $\frac{1}{2}$  for the other, and it ripens 15 days earlier.

410 — **The Improvement of Cotton by Selection, in India.** — *Bulletin of the Imperial Institute*, Vol. XV, No. 2, pp. 149-177. London, April-June, 1917.

Selection experiments with cotton have been carried out for several years in many of the Agricultural Stations in India, and are still being continued with important results.

**CENTRAL PROVINCES AND BERAR.** — Selection is carried out at the Sindewahi (Chanda District, Central Provinces) and Akola (Berar) Agricultural Stations. The following cottons are grown :

An American upland cotton called "buri".

The native cotton "bani" (*Gossypium indicum*).

The native cottons, "Jari", which include a mixture of races of *Gossypium neglectum* namely, *rosea*, *cutchica*, *malvensis* and *vera*.

A selected line known as k 7.

A number of hybrids, amongst them bani  $\times$  *rosea*, bani  $\times$  mathio, bani  $\times$  deshi Lahore (this last is a white-flowered variety introduced from the Punjab).

Of all the cottons studied, *rosea* gives the best yield, and is now grown over 700 000 out of the 4 750 000 acres under cotton in the Central Provinces. In 1914-15 it gave a profit exceeding that given by ordinary cotton by 21s. per acre. The yields of lint obtained from the several varieties at Akola in 1916 were :

Variety	Lbs. of lint per acre
<i>Gossypium neglectum rosea</i> . . . . .	267.5
» » <i>culchilla</i> . . . . .	255.9
» » <i>malvensis</i> . . . . .	190.4
» » <i>vera</i> . . . . .	171.0
Saugor jari . . . . .	247.6
Berar jari . . . . .	172.4
Buri . . . . .	180.1
Bani . . . . .	148.8
Bani × deshi Lahore (Sindewahi cross) . . . . .	184.5

PUNJAB. — The experiments are being carried out at Lyallpur with American, Egyptian, and Cambodia cottons, but only the American varieties have given positive results, and many pure lines have been isolated from the varieties acclimatised at Lyallpur. Of these 4F is distinguished by the quality and yield of its lint and by its resistance to insect pests. In 1914-15 2 000 acres were sown with this variety, and it is hoped that in time it will replace entirely the ordinary American cotton of the district.

The native cotton of the Punjab, known as "desi", consists of a mixture of varieties of the three species *Gossypium sanguineum*, *G. indicum* and *G. neglectum*. Several main types have been isolated by selection, but they are all inferior to American cotton. Mention may be made of a form of *G. sanguineum*, which gives good yields, and is grown over 1 450 acres in the Lyallpur district.

BOMBAY. — Selection, carried out at the Mirpurkhas Farm, Sind, deals particularly with the Mitafifi (Egyptian), Sindhi (indigenous) types and several improved American Upland cottons with very long lint.

All the samples examined at the Imperial Institute in 1912-13 were of good quality. In a few cases only (Toole's, Griffen, and Black Rattler) was there a little irregularity in length or strength, but these defects might be removed by acclimatation and systematic selection of seed from the best plants.

BURMA. — The native cottons of Burma are, on the whole, of poor quality, but some of the strains have a fairly long staple, and are equal in value to the best Indian cottons, and only a little inferior to "middling" American. The most widely cultivated variety in the dry, central tracts of Burma, is "wa-galé", or "wa-pyu", which supplies  $\frac{3}{4}$  of the total production of the country. Then come "wa-ni", with red fibre, grown on a small scale for local use where "wa-galé" is cultivated, the two being often mixed; "wa-gyi", a perennial cotton with white fibre, grown to a small extent in Myingyan, Thayetmyo and Minbu; "thinbaw-wa", a form of Pernambuco cotton grown in the Amherst district. From the wa-gyi and wa-galé varieties have been isolated lines with specially high ginning yields. Native cotton is inferior to Cambodia cotton obtained from Madras and now being introduced into several districts.

411 - The Effect of Selection on "Kumpta" Cotton and on the Quality of Its Fibre, in India. — See No. 419 of this Review.

412 - Yields of Different Varieties of Maize in Illinois. — BURLISON, W. I. and ALLYN, O. M., in the *University of Illinois Agricultural Experiment Station, Bulletin No. 191*, pp. 409-424, 11 Tables. Urbana, Illinois, August, 1916.

CEREAL  
AND PULSE  
CROPS

The experiments described were carried out during 15 years, chiefly at Dekalb (Dekalb county), Urbana (Champaign county), and Fairfield (Wayne county), Illinois, and are still in progress.

The climatic conditions in the different parts of Illinois vary greatly. The rainfall in the north is 33.64 inches per annum, in the centre, 35.76 inches, and in the south, 40.25 inches. The average length of the growing season is 166 days in the north, 173 days in the centre and 188 days in the south. The soil in which the experiments are carried out is brown silt loam at Dekalb and Urbana, and grey silt loam on compact clay at Fairfield. The fields have, for the most part, been regularly supplied with phosphate rock, limestone, and either farm manure or crop residues. The methods used are those adopted by the leading maize growers.

NORTHERN ILLINOIS. — The experiments were started in 1903 at Myrtle (Ogle county), transferred in 1905 to Sycamore (Dekalb county), and, since 1906, continued at Dekalb. The rotation at Dekalb was maize, maize, oats and clover. The varieties tested were: — Riley's Favourite, Reid's Yellow Dent, Funk's 90 Day, Leaming, Goldmine, Pride of the North, Boone County White, White Superior, Western Plowman, Champion White Pearl, Silvermine, Golden Eagle, Farmer's Interest and Lockwood's Yellow Dent. Western Plowman invariably gave the highest yield with the exception of Will County Favourite, grown for two years only, and the same variety by origin. The other high-yielding varieties grown for a minimum of four years are in order of yield, Riley's Favourite, Griffith's Early Dent, Reid's Yellow Dent, Hecker's Red and Funk's 90 Day.

CENTRAL ILLINOIS. — The trials reported from Urbana have been in progress since 1901. The rotations were: — 1) maize, maize, oats and clover; 2) wheat, maize, oats and clover; 3) combination rotation of alfalfa, maize potatoes and soybeans. Of the 17 varieties tested, Reids' Yellow Dent gave the highest yield of any grown for a minimum of five years. Very good yields were obtained with Boone County White, Champion White Pearl, Leaming, Silvermine and Riley's Favourite, while Golden Eagle, Farmer's Interest, Johnson County White and Beatty's Yellow proved highly satisfactory.

Fifteen varieties were also tested at Decatur, Auburn, Mattoon and Sibley. In these trials Reid's Yellow Dent was out-yielded by three varieties. — Funk's Yellow Dent, Farmer's Interest and White Superior — but the difference was not marked, and the varieties only tested for two years.

SOUTHERN ILLINOIS. — The tests were started in 1906. The highest yields for a minimum of four years were obtained with the following varieties in the order given: — Funk's 90 Day, Reid's Yellow Dent, Perrine's White Pearl and Chinese Poor Land. Sutton's Favourite, Strout's Red,

Will County Favourite and Western Plowman, though grown for one year only, promise well.

Experiments were also made on untreated land at Fairfield. They gave the expected results; *i. e.* varieties grown commonly in southern Illinois adapted to the soil out-yielded those which gave the best results under less unfavourable conditions. In these trials Champion White Pearl, Perine's White Pearl and Easterly's White varieties gave the highest yields for the three years 1911-1913.

The bulletin concludes with a brief history of certain varieties of maize.

413 - **A New Early Variety of Dwarf Maize, Obtained in the Province of Reggio-Emilia, Italy.** — See No. 409 of this *Review*.

414 - **Indo-Chinese Rice.** — CAPUS, G., in *Annales de Géographie*, Year XXVII, No. 145, pp. 25-42. Paris, January 15, 1918.

The methods of increasing the production of rice in Indo-China and of improving its quality are discussed. The different varieties grown ("Gocong" or "Kadong", "Baixan" and "Vinhlong" or "Longho") should be sorted, both for milling and for exportation. The selection of seed is prevented by the hold of the Chinese over the rice trade. The Chinese buy the rice in small lots, which they mix for sale. The only method of opposing this practice would be by founding European factories which would insist on sorting when buying.

At the exhibition organised in 1911 by the Colonial Institute of Marseilles were 796 samples of rice from Cochinchina, together with information on their origin, yield per acre and weight of grain per bushel. An investigation into the commercial value of the hulled rice showed that, besides very many valuable varieties, 14 at least, qualified as very valuable, were particularly mentioned because of their commercial qualities. The value of the white rice of 19 varieties was stated to be equal to those quoted at 10s. to 15s. per cwt.

Special stress is laid on:— 1) the usefulness of improving the quality and yield by the choice of seeds from the best native varieties (a method superior to the introduction of good foreign varieties, for this is often difficult and the introduced varieties degenerate rapidly); 2) individual selection; 3) the use of pure and pedigreed lines; 4) the improvement of the crops.

Cochinchina produces annually over 2 million metric tons of paddy on 3 706 650 acres of rice fields. If an increase of 20 % of the present yield were obtained, the annual gain would be 400 000 metric tons, representing a value of about £ 158 590. The annual production of about 5 million metric tons of the three rice-growing countries of the Union (Cochinchina, Cambodia and Tonkin) would increase by about 1 million tons, worth, at the normal local price of paddy, £ 396 500.

#### STARCH CROPS

415 - **The Composition of the Potato Plant at Various Stages of Development.** — RAMSAY, J. T. and ROBERTSON, W. C., in *The Journal of the Department of Agriculture of Victoria*, Vol. XV, Pt. 2, pp. 641-655 + 2 figs. Melbourne, November, 1917.

*Object of the experiment.* — This experiment was carried out to determine:— 1) the rate of assimilation of food from the soil; 2) the relative

proportion of each of the principal elements contained in the plant at various stages of its growth.

*Method.* — The crop was grown in synthetic soil composed of 13 parts Carrum sand, 2 parts clayloam surface soil and 1 part well-rotted farmyard manure. When well mixed its composition per 100 000 parts was, nitrogen 103, phosphoric acid 22, potash 82, lime 201, magnesia 55. It was put in small 18 × 18 × 18 inch hardwood boxes, each of which held 130 lbs. of soil. The potatoes were planted 4 inches below the surface, and the boxes placed in the ground, their top being practically level with the surface. Care was taken to ensure good draining and the plants were well watered. Each box received as fertiliser: — superphosphate  $\frac{1}{2}$  oz., ammonium sulphate 1 oz., dried blood 1 oz., potassium sulphate  $\frac{1}{2}$  oz. The potatoes were planted on December 17, 1916. All the potatoes were of the Up-to-Date variety and their average weight was 75 grams. When the plants emerged a top dressing of  $\frac{3}{4}$  oz. of sodium nitrate per box was applied. Later each box was mulched with buffalo grass (*Buchloe dactyloides*) cuttings, and the surface soil was kept loose throughout the period of growth.

*Harvests.* — The harvests were at intervals of approximately one month (see Table I). The total period of ripening was 124 days. Care was always taken to collect the whole plant without damaging or tearing the root.

*Results.* — The results were remarkably uniform in the duplicate sets from each harvest, they are summarised in the following tables.

#### TOTAL DRY MATTER IN THE PLANT.

TABLE I. — *Yield of dry matter at various stages of growth.*

Date of harvest	Grams of dry matter per plant				Dry matter per acre (12 000 plants per acre)			
	Haulm	Tubers	Roots	Total	Haulm	Tubers	Roots	Total
					lb.	lb.	lb.	lb.
1st. (January 29) . . . .	49.41	3.44	6.29	59.14	1 741	121	221	2 072
2nd. (February 23) . . .	158.90	147.10	14.32	320.32	5 600	5 184	504	11 288
3rd. (March 26) . . . .	219.50	352.35	15.31	587.16	7 285	12 418	539	20 692
4th. (March 30) . . . .	213.00	423.40	10.70	647.10	6 506	14 921	377	22 804

TABLE II. — *Approximate acre green weight of potatoes at the different harvests.*

	1st.				2nd.				3rd.				4th.			
	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.	tons	cwt.	qrs.	lbs.
Weight of tubers per acre . . .	0	4	0	6	8	13	2	8	20	15	3	4	24	18	3	0

TABLE III. — *Approximate percentage production.*

Harvest	Root %	Haulm %	Tuber %
1st . . . . .	11	83.5	5.8
2nd. . . . .	3.5	42	55.0
3rd. . . . .	0.3	23	77.0
4th. . . . .	—	—	100.0

TABLE IV. — *Analysis of seed sets at various harvests.*

	Average weight of dry matter	Nitrogen		Phosphoric acid		Potash		Lime	Magne-sia
	gm.	%	gm.	%	gm.	%	gm.	%	%
Original set . . .	14.95	1.35	0.20	0.32	0.048	2.84	0.42	0.10	0.15
At 1st. harvest. .	12.17	0.70	0.09	0.29	0.035	4.13	0.50	n. e.	n. e.
At 2nd. " . .	9.61	1.52	0.12	0.28	0.027	4.75	0.45	n. e.	n. e.
At 3rd. " . .	5.80	1.75	0.10	0.33	0.020	4.90	0.28	n. e.	n. e.
At 4th. " . .	4.70	2.04	0.10	0.43	0.022	5.15	0.24	n. e.	n. e.

n. e. = not estimated.

The results in these tables show distinctly that the potato plant does not develop in a uniform manner throughout the period of its growth. The development of the root practically ceases at the end of the second month when 93% of the root are already formed. The development of the haulms ceases after the 3rd. month; only the tubers continue to grow during the 4th. month. During the 1st. month the plant produces 9% of its total dry matter, 50% during the 2nd., and 91% during the 3rd. Thus the life of the potato really includes three cycles—preparation (it is here the plant needs assistance), production, maturation.

The results obtained by the authors agree with those obtained by H. WILFARTH and H. ROMER at the Ducal Agricultural Station at Bernberg, Anhalt (Germany), in 1903-1904. These workers carried out experiments on a much larger scale to determine whether, during growth, the potato plant returns part of its food to the soil.

The principal results may be summarised as follows:—

- 1) The 3 essential plant foods—nitrogen, potash and phosphoric



TABLE V. — *Chemical composition of the potato plant at the different harvests (total dry*

Harvest	Composition, per cent.					Yield in lbs. per acre (12 000 plants per acre)				
	Nitro- gen	Phosphoric acid	Potash	Lime	Magne- sia	Nitro- gen	Phosphoric acid	Potash	Lime	Magne- sia
<i>Haulm</i>										
1st.	4.82	1.02	7.15	1.69	1.25	62.9	13.3	91.7	22.1	16.3
2nd.	3.91	0.93	6.23	1.62	1.08	164.2	39.0	261.7	68.0	45.4
3rd.	2.47	0.36	4.58	2.18	1.16	143.3	20.9	265.7	126.5	67.3
4th.	1.99	0.33	3.74	2.33	1.14	112.2	18.6	210.9	131.4	64.3
<i>Tubers.</i>										
1st.	1.98	0.97	4.65	0.15	0.22	1.8	0.9	4.2	0.14	0.20
2nd.	1.79	0.82	2.98	0.10	0.14	69.5	31.9	115.8	3.90	5.40
3rd.	1.68	0.66	3.08	0.11	0.19	156.4	61.5	286.9	10.20	17.70
4th.	1.80	0.69	3.20	0.15	0.20	204.9	77.4	358.9	16.82	22.40
<i>Roots.</i>										
1st.	2.60	0.75	3.70	1.30	0.76	4.3	1.2	6.0	2.1	1.25
2nd.	2.02	0.83	2.12	1.27	0.66	7.6	3.2	8.0	4.8	2.50
3rd.	1.72	0.35	1.52	1.40	0.73	6.0	1.4	6.0	5.7	2.90
4th. (*)	1.88	0.40	0.82	1.31	0.71	5.3	1.1	2.3	3.7	2.00
<i>Whole plant.</i>										
1st.	4.22	0.99	6.53	1.5	1.10	69.0	15.4	102.0	24.3	17.8
2nd.	2.85	0.87	4.55	0.9	0.63	241.3	74.0	385.4	76.7	53.3
3rd.	1.97	0.54	3.60	0.9	0.56	306.7	83.8	558.7	142.4	88.8
4th. (*)	1.86	0.56	3.32	0.9	0.52	319.0	97.0	573.0	152.0	90.0

\* Owing to the advanced stage of decomposition difficulty was experienced in collecting all the roots at the 4th. harvest. The loss was about 30 %, which would make the analytical figures obtained from the 4th. harvest of the roots about equal to those obtained from the 3rd.

acid — once absorbed by the potato plant are utilised, no migration from the plant to the soil taking place.

2) The critical period of growth is the first 6 to 8 weeks.

3) The greater part of the phosphoric acid enters the plant at the early stage of growth, concentrating in the haulm, and then playing an important part by migrating to the stolons for tuber formation.

4) Potash and nitrogen play a consistently even part throughout the growing period.

5) Practically the whole of the root development takes place during the first 2 months.

TABLE VI. — *Plant-food ratio in the roots at the different harvests.*

Harvest	Phosphoric acid	Nitrogen	Potash	Lime	Magnesia
<i>Haulm.</i>					
1st. . . . .	I	4.7	7.0	1.6	1.2
2nd. . . . .	I	4.2	6.7	1.7	1.1
3rd. . . . .	I	6.8	12.9	6.0	3.2
4th. . . . .	I	6.6	11.3	7.0	3.5
<i>Tubers.</i>					
1st. . . . .	I	2.0	4.8	0.15	0.2
2nd. . . . .	I	2.2	3.6	0.1	0.2
3rd. . . . .	I	2.5	4.6	0.2	0.3
4th. . . . .	I	2.3	4.0	0.2	0.3
<i>Roots.</i>					
1st. . . . .	I	3.5	5.0	1.8	1.0
2nd. . . . .	I	2.4	2.5	1.5	0.8
3rd. . . . .	I	5.0	4.4	4.0	2.0
4th. . . . .	I	4.7	2.0	3.3	1.8

TABLE VII. — *Soluble plant-food in the potato haulm at the different harvests.*

Harvest	Nitrogen		Phosphoric acid		Potash	
	% soluble	of total in plant	% soluble	of total in plant	% soluble	% of total in plant
1st. . . . .	1.55	32	0.81	80	7.13	110 (approx)
2nd. . . . .	0.80	20	0.67	72	5.34	86 ( " )
3rd. . . . .	0.77	30	0.27	75	4.50	100 ( " )
4th. . . . .	0.42	21	0.27	80	3.54	100 ( " )

6) Haulm development is most active during the first 2 months.

7) The amounts of lime and magnesia assimilated by the potato plant seem to bear a definite relation.

8) The very young potato tuber is richer in phosphoric acid than the semi or mature tuber.

9) Phosphoric acid and nitrogen present in the seed set are largely utilised for sprout formation (25 % for the former and 50 % for the latter). Potash, apparently, is not utilised directly.

10) The results of the experiments taken collectively show that the plants must be manured during the first month.

11) Potatoes can be grown on poor sandy soil provided that available plant-food in the form of artificial fertilisers and farmyard manure are judi-

ciously applied. In such cases the quantity and quality of the produce may may be favourably compared with that from the best potato soils.

12) The value of the dried haulms and roots may be compared to farmyard manure in favour of the dried haulms, 1 ton of which supplies 3 times as much nitrogen and phosphoric acid, and about 10 times as much potash as 1 ton of farmyard manure.

13) The composition of the potato tuber under experimental conditions may be influenced in so far as the phosphoric acid content is concerned.

14) During the growing period the potato plant utilises phosphoric acid, nitrogen and potash, in the proportion of 1, 4, 6, *i. e.* 1 part of phosphoric acid to 4 parts of nitrogen to 6 parts of potash.

416 - **Methods of Applying Fertilizer to Sweet Potatoes.** — DURST, C. E., in the *University of Illinois Agricultural Experiment Station, Bulletin* No. 188, pp. 268-278, 2 Figs., 6 Tables Urbana, Ill., April, 1916.

Fertiliser experiments with sweet potatoes were carried out during the five years 1910-1914 at Anna, in Union County, the most important sweet-potato growing centre. Eight plots, each 66 × 20 feet, were used; two of these (plots 1 and 5) were control plots, three (plots 6, 7, and 8) were fertilised under the ridge, and three (plots 2, 3 and 4) were fertilised broadcast, each with:— 1) home mixed fertiliser (2 parts by weight of steamed bone, with 12.5 % phosphorus, 2 parts of dried blood, with 14 % nitrogen, and 1 part potassium sulphate, with 42.5 % potash); 2) 640 lbs. manure, containing 10 lbs. nitrogen, 3 lbs. phosphorus and 8 lbs. potash per ton; 3) 16 lbs. of steamed bone.

The potatoes harvested were graded according to the local method into "table" potatoes (1½ inch or more in diameter, of good shape), "seed" potatoes (of good shape and rather smaller than the first class), and "strings" (deficient in size and shape). The average yields obtained were:—

Plot	Table potatoes, bushels per acre.	Seed potatoes, bushels per acre.	Strings % in weight of table potatoes
1	76.07	35.17	24.29
2	94.16	33.32	20.93
3	106.42	33.82	20.74
4	89.57	33.51	20.57
5	80.96	30.03	26.57
6	103.28	29.12	25.41
7	130.92	28.15	19.26
8	100.79	33.38	20.76

As the price of sweet potatoes varies according to the season in which they are marketed the results given have been based on two set prices:— 1) 50 cents per bushel for the table grade and 25 cents per bushel for the seed grade; 2) 75 cents per bushel for both grades (price of stored potatoes).

All the fertilised plots gave higher unit yields than the control plots, but only manure and steamed bone under the ridge gave a sufficiently great increase to bring in any appreciable profit when the cost of the fertiliser

and the elements left in the soil are taken into account. All the treatments supplied more of the elements for which they were used than was removed by the crop. Manure applied under the ridge not only gave the highest net returns, but also left more fertiliser value in the soil than any of the other treatments except manure broadcast. Manure also leaves considerably more organic matter in the soil than does any other fertiliser.

**Conclusions.** — All the fertiliser treatments tested in the experiments increase both the unit yields and the percentage of table potatoes. With the possible exception of the home-mixed fertiliser, higher percentages of table potatoes are produced when the fertiliser is applied under the ridge than when it is broadcast. When considering the advisability of any of these treatments, the prices likely to be received for the crop should be taken into account, as the higher these are, the greater is the profit made on the fertiliser.

A large proportion of the fertiliser remains in the soil for the next crop.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

417 — **Grasses and Other Fodder Plants of Victoria, Australia.** — AUDAS, J. W., in *The Journal of the Department of Agriculture of Victoria*, Vol. XV, Pt. 12, pp. 711-723, 3 Tables, 3 Figs. Melbourne, December, 1917.

**NATIVE FODDER GRASSES.** — The native grasses of Victoria belong to 136 species, divided among the following 49 genera : —

*Panicum*, 15 species; *Chamaeraphis*, 2; *Isachne*, 1; *Oplismenus*, 1; *Setaria*, 4; *Spinifex*, 2; *Tragus*, 1; *Neurachne*, 3; *Zoysia*, 1; *Imperata*, 1; *Pollinia*, 1; *Lepturus*, 2; *Hemarthria*, 1; *Andropogon*, 8; *Chrysopogon*, 2; *Sorghum*, 2; *Anthistiria*, 2; *Alopecurus*, 1; *Tetrarrhena*, 3; *Microlaena*, 1; *Hierochloa*, 2; *Aristida*, 6; *Stipa*, 13; *Dichelachne*, 2; *Pentapogon*, 1; *Amphipogon*, 1; *Pappophorum*, 1; *Sporobolus*, 3; *Agrostis*, 3; *Deyeuxia*, 7; *Deschampsia*, 1; *Trisetum*, 1; *Anisopogon*, 1; *Danthonia*, 6; *Cynodon*, 1; *Chloris*, 2; *Eleusine*, 1; *Poa*, 4; *Glyceria*, 5; *Diplachne*, 2; *Triodia*, 1; *Distichlis*, 1; *Bromus*, 1; *Eragrostis*, 7; *Elythrophorus*, 1; *Triraphis*, 1; *Agropyron*, 3; *Arundo*, 1.

All are fairly well distributed throughout the state. The most valuable and nutritious grasses amongst them are 15 species of *Panicum*, 8 of *Andropogon*, 7 of *Deyeuxia*, 7 of *Eragrostis* (some of which are remarkable for their resistance to drought), 4 of *Glyceria*, 2 of *Anthistiria*, 2 of *Chloris*, 2 of *Diplachne*, 4 of *Poa* (one of which might be used for the manufacture of fibre), 3 of *Sporobolus* (one of which could be used in paper-making).

On the other hand, there are a large number of undesirable grasses, covering, in some places, a wide area, depreciating its stock-carrying capacity. They are : —

*Stipa elegantissima*; *S. flavescens*; *S. teretifolia*; *S. eremophila*; *S. setacea*; *S. Luehmanni*; *S. acroclita*; *S. McAlpinei*; *S. Muelleri*; *S. semibarbata*; *S. pubescens*; *S. aristiglumis*; *S. scabra*; *Aristida arenaria*; *A. Behriana*; *A. leptopoda*; *A. vagans*; *A. ramosa*; *A. calycina*; *Triodia irritans*, th's last chiefly on account of its sharp-pointed leaves.

**NATIVE PASTURE GRASSES : —**

*Andropogon pertusus*, pitted grass; *A. affinis*, crown beard grass; *A. refractus*, turpentine grass; *A. sericeus*, silky blue grass; *Agropyron scabrum*, common wheat grass; *Anthistiria imberbis*, kangaroo grass; *Chloris truncata*, windmill grass; *C. acicularis*, lesser star grass; *Cynodon Dactylon*, Indian couch grass; *Danthonia penicillata*, Wallaby grass; *Dichelachne*

*crinita*, long hair plume grass; *Eleusine cruciata*, finger grass; *Eragrostis Brownii*, common love grass; *E. pilosa*, soft love grass; *Microloena stipoides*, weeping grass; *Panicum decompositum*, umbrella grass; *P. divaricatissimum*, spider grass; *P. effusum*, hairy panic grass; *P. gracile*, slender panic grass; *P. leucophacum*, cottony panic grass; *P. Mitchellii*, spreading panic grass.

#### NATIVE GRASSES FOR MOIST SOILS: —

*Glyceria fluitans*, manna grass; *G. Fordeana*, sweet swamp grass; *G. ramigera*, bamboo grass; *Hemarthria compressa*, mat grass; *Imperata arundinacea*, blady grass; *Panicum melantherum*, black seeded panic grass; *Arundo Phragmites*, common reed grass; *Microloena stipoides*, weeping grass; *Isachne australis*, swamp millet; *Diplachne fusca*, brown beetle grass; *Danthonia nervosa*, swamp Wallaby grass.

#### NATIVE GRASSES FOR DRY SOILS: —

*Amphipogon strictus*, bearded heads; *Anisopogon avenaceus*, oat spear grass; *Echinopogon ovatus*, hedge hog grass; *Eragrostis lacunaria*, Mullee love grass; *Neurachne Mitchelliana*, Mitchell mulga grass; *Pappophorum nigricans*, nigger head; *Pollinia fulva*, browntop; *Chloris truncata*, windmill grass; *Eleusine cruciata*, finger grass; *Panicum effusum*, hairy panic grass; *P. prolutum*, pallid panic grass; *P. decompositum*, umbrella grass.

#### NATIVE GRASSES FOR BINDING SANDS: —

*Distichlis maritima*, salt grass; *Imperata arundinacea*; *Festuca littoralis*, coast fescue; *Spinifex hirsutus*, hairy spinifex; *Sporobolus virginicus*, Virginian rat-tail grass; *Zoysia pungens*, prickly couch grass; *Hemarthria compressa*; *Cynodon Dactylon*.

During spring and summer there is generally abundant, rich pasture, but the want of it is usually felt in winter. One of the most common grasses is *Danthonia penicillata*; it is very nutritious and relished by all kinds of stock. *Anthistiria imberbis* produces little seed, and it is advisable to remove stock from it during spring and summer; if this is done it grows sufficiently high to hide sheep, which like it very much. Stock willingly eat *Imperata arundinacea*, which is also used for thatching. *Panicum Crus-Galli* attains a height of 4 to 5 feet, and is most suitable for moist districts. Perennial are *Pappophorum nigricans*; *Eragrostis Brownii*; *Amphipogon strictus*; *Panicum divaricatissimum* (drought-resistant); *P. gracile*; *Microloena stipoides*; *Hemarthria compressa*; *Festuca littoralis*; *F. duriuscula* (composition of grass dried at 212° F: — soluble albuminoids, 0.44 %; insoluble albuminoids, 3.94 %; digestible fibre, 17.18 %; woody fibre, 60.99 %; soluble mineral matter, 4.01 %; insoluble mineral matter, 2.26 %; chlorophyll, soluble carbohydrates, etc., 11.18 %; the grass contains 61.98 % of water).

#### NATIVE WILD FODDER PLANTS OTHER THAN GRAMINEAE: —

*Trigonella suavissima*, sweet fenugreek; *Erodium cynorhizon*, blue Erodium; *Geranium dissectum*, cut-leaved geranium; *Lavatera plebeia*, austral holly-hock; *Daucus brachiatus*, austral carrot; *Plantago varia*, variable plantain; *Lotus corniculatus*, birdsfoot trefoil.

#### EXOTIC FODDER PLANTS NATURALISED IN VICTORIA: —

GRAMINEAE: — There are about 95 species, many of which are widely cultivated. The best are: —

*Dactylis glomerata*; *Lolium perenne*; *Poa pratensis*; *Bromus unioloides*; *Sorghum halepense*; *Phleum pratense*; *Festuca elatior*; *Alopecurus pratensis*; *Cynosurus cristatus* (drought-resistant); *Anthoxanthum odoratum*; *Trisetum pratense*; *Paspalum dilatatum*; *Eragrostis alba*; *Milium effusum* (the two last for damp soils).

*Ammophila arundinacea* and *Elymus arenarius* are very useful for fixing sand; both are refused by stock, but are excellent for thatching.

ACCLIMATISED LEGUMINEAE AND FODDER PLANTS OF OTHER FAMILIES: —

*Trifolium repens*; *T. hybridum*; *P. pratense*; *T. fragiferum*; *T. resupinatum*; *T. subterraneum*; *T. tomentosum*; *T. glomeratum*; *T. incarnatum*; *T. minus*; *T. parviflorum*; *T. procumbens*; *T. striatum*; *Medicago sativa*; *M. tribuloides*; *M. maculata*; *M. denticulata*; *M. orbicularis*; *M. scutellata*; *M. lupulina*; *Melilotus alba*; *M. parviflora*; *Poterium Sanguisorba*; *Plantago lanceolata*; *Vicia sativa*; *Anthyllis vulneraria*; *Onobrychis sativa*; *Trigonella ornithopoides*.

418 — **Bokkara or Sweet Clover (*Melilotus alba*) in New South Wales.** — BREAKWELL, E., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 10, pp. 731-734, 1 fig. Sydney, October, 1917.

The fact that Bokkara or sweet clover (*Melilotus alba*) is one of the most widely cultivated fodder plants in the United States, lead to cultivation experiments being made with it in New South Wales, on the Glen Innes and Yanco farms. It is generally a biennial plant, but, in the two districts mentioned it flowered to a small extent during the first year, and seeded heavily during the second. The abundant flowers are very attractive to bees, which give a large yield with it.

TRIALS AT GLEN INNES. — Sweet clover, sown on September 10, 1915, in rows 2 ½ ft. apart on 1/10 acre, germinated well (75 %) and made good growth during the dry spring and the summer. The main stem was not very high, but the secondary ones were numerous and long. From the first year the spaces between the lines were completely filled, and there was a profuse yield of tender, but bitter, fodder. The winter frosts destroyed the aerial parts of the plants, but they grew again strongly in Spring. On November 20 the plants were 3 ft. high, on January 20, from 7 to 8 ft. high, and were setting seed well. The ripe plants are woody, and they should be grazed or cut for hay when still young. Horses, cattle and sheep will not eat it green.

TRIALS AT YANCO. — Comparative trials were made with American seed and seed bought in Australia. The first gave 6.4 times more green fodder than the other. Both are deep-rooters.

The advantages of sweet clover are: — it is excellent for bees; it eradicates weeds; it is a good green manure; it prepares the soil for lucerne by breaking it to a great depth with its roots and enriching it with the nodule bacteria essential to the growth of lucerne. Its disadvantage lies in the coumarin it contains, which gives it a bitter, unappetising taste. Opinion on this subject is contradictory, and it appears that animals eventually become accustomed to it and eat it willingly.

FIBRE CROPS

419 — **The Selection of Kumpta Cotton in India.** — KOTTUR, G. I., in *Department of Agriculture, Bombay, Bulletin* No. 84, pp. 1-2. Poona, 1917.

Practical advice on the choice of stock plants of the "Kumpta" variety is given. The plants should have the following qualities: — 1) well-developed stem with many internodes; 2) high ginning percentage; 3) pods with long, fine, strong staple. The plants in which the capsules open prematurely should be removed as they give only little lint of low quality.

The seed thus obtained should be sown in lines, all the seeds of one plant in one line. At the time of harvest the seed from the best line may be distributed as selected seed. These simple methods, which may be adopted by all growers, have already given appreciable results, as is seen below: —

	Yield per acre		Ginning per cent	Value per candy *
	Kapas	Clean cotton		
	lbs.	lbs.		
"Kumpta" unselected . . .	564	148	26.2	335 rupees **
"Kumpta" selected . . .	612	171	28.0	350 "

\* 1 candy = 784 lbs. — \*\* 1 silver rupee = 1s. 4d. at par.

It is seen that selected cotton is superior to unselected cotton both in yield and the quality of the product.

420 — **Ambari or Deccan Hemp, *Hibiscus Cannabinus* L., in South Africa.** — POLE-EVANS, I. B., in *The South African Journal of Industries*, Vol. I, No. 3, pp. 198-208, 6 Plates. Pretoria, November, 1917.

*Hibiscus cannabinus* L., known in the British colonies as Ambari Hemp, Deccan Hemp, Gambo Hemp and Bimlipatam Hemp, is called in South Africa "the wild stock rose" (1). Up to the present it has been practically unknown in this district as a fibre plant.

The importance of the cultivation of this plant is pointed out, and the attention of farmers and merchants in particular is drawn to it. The botanical and cultural characteristics of the plant are described, and stress laid on the value and industrial use of the fibre. The results are also given of an examination made by the Imperial Institute of samples of *Hibiscus cannabinus* fibre grown in the Transvaal, and these results show it to be of good quality.

The extraction of the fibre has been studied in the Botanical Laboratories, Pretoria, and it has been shown that there would be no difficulty in retting it under South African conditions. The length of time required for immersion in water of a temperature varying from 18 to 26° C. is from 10 to 14 days. A 10.7 to 11.9% yield of fibre of excellent quality has been obtained.

Before *Hibiscus cannabinus* can be recommended to growers for cultivation it is necessary to make a further study of the plant and its fibre, to investigate the questions of a market for it in South Africa, of the profit the grower may realise, and the best varieties to be grown, both as regards yield and the quality of the fibre. Such a study would require at least five years and careful investigation both in the field and in the laboratory. *Hibiscus cannabinus* does well in many parts of South Africa, and there appears no reason why it should not give as good results there as in India.

(1) It is the "da", or "dâh", of French West Africa. (Ed.)

OIL-YIELDING  
CROPS

421 - Contribution to the Chemical Study of the Nuts of "Sanga-sanga" or *Ricinodendron africanum*. — PIERAERTS, in the *Annales du Musée colonial de Marseille*, Year XXV, Series, 3, Vol. V, pp. 27-37. Paris, Marseilles, 1917.

The author (Keeper of the Belgian Congo Museum) has made a chemical study of the nuts of *Ricinodendron africanum* Mull. Arg. (fam. Euphorbiaceae), sent to him from Ganda-Sundi (Lower Congo). *R. africanum* is known as "sanga-sanga" in that country, "essang", "enguessang" or "issanguila" in the French Congo and Gabon, and "usa sana" in the other countries of west equatorial Africa. It is a tree some 80 to 100 feet high and 10 feet round, with very spongy wood of poor quality, not even good enough for heating. Its nuts are about the size of a hazel-nut and weigh from 1.250 to 2.400 gm; with its extremely hard, black shell it will keep a long time.

The nut has a very wrinkled surface, and is composed of: — 1) the shell (endocarp), very hard, black outside and milky white inside; 2) the kernel (really the seed), completely filling the shell in sound specimens. The unsorted nuts give 72 % of shell and 28 % of kernel. The kernel gives:

Moisture . . . . .	17.64 %
Dry matter . . . . .	82.36 %
Total mineral matter . . . . .	7.32 % of the dry matter
Total mineral matter insoluble in water . . . . .	6.70 % of the dry matter

That is, 91.53% of the total ash for the last two.

On extraction with anhydrous ether, the kernel gives 55.29 % of oil (i. e., 67.3 % of the dry matter), which corresponds to a content of 18.52 % for sorted nuts and 15.48 % for unsorted nuts. The oil extracted is limpid, pale yellow, and of a sweet flavour, leaving an earthy taste; it has no special odour. It has the following characteristics: —

Specific weight at $\frac{15^{\circ}}{15^{\circ}}$ . . . . .	0.9345
Critical temperature of solution in absolute alcohol . . . . .	90.2°
Refractive index at 19.5° . . . . .	1.5028
Polarimetric test . . . . .	$\alpha_D = + 0.04^{\circ}$
Acid index . . . . .	0.86
(calculated as oleic acid, it is 0.43 %).	
Mauméné test . . . . .	79°
Bromides insoluble in ether . . . . .	nil.
Insoluble and unsaponifiable fatty acids . . . . .	98.85 %
Glycerine . . . . .	9.77 %
Saponification index . . . . .	194.4
Elaidin test (very viscous, brownishyellow mass)	
Melting point . . . . .	32.3° to 34.5°C.
Saponification point (the melted acids remain in fusion at laboratory temperature (20°C) and only resolidify after two hours).	

The action of the air (and possibly of light as well), on "sanga-sanga" oil constitutes, as regards the drying properties, a complex chemical problem. As regards the action of iodine, the oil dissolved in chloroform, used for the polarimetric examination, was poured, while continually shaking, into an equal volume of a saturated solution of iodine in chloroform;



after a few moments the mixture set in a gelatinous mass of such a consistency that it did not flow on inverting the beaker.

The refractive index of the oil is higher than that of any other vegetable oil known, save abrasin oil. "Sanga-sanga" oil is a drying oil; it seems more drying than linseed, as it solidifies much more quickly. It might well be used for waterproofing, as a mastic for caulking ship's hulls or other objects having joints needing stopping up, and as mortar or lamp oil.

The kernel cake has an exceptionally high nitrogen content; its phosphoric acid content is also very high. This cake would be excellent as a fertiliser for nurseries, gardens, etc. If it proves to contain no toxic matter, it would provide a first class food for live stock and poultry.

422 - **Commercial Onion Growing in Indiana.** — SAYRE, C. B. (under the direction of WOODBURY, C. G.), in *Purdue University Agricultural Experiment Station, Circular No. 57*, pp. 27, 12 Fig. Lafayette, Ind., September, 1916.

HORTICULTURE

Onions are grown very extensively on the peat or muck soils of northern Indiana, the crop of 1914 amounting to 2 210 325 bushels.

Good drainage is an important factor in selecting muck soil for profitable onion growing. The soil should be well prepared before planting; many growers prefer to prepare the land in autumn. Rolling is of great value.

Potash is the element most deficient in the non-acid muck soils, and muriate of potash applied at the rate of 200 to 400 pounds per acre will give a very profitable increase in yield with normal prices. Acid phosphate at the rate of 300 to 400 pounds per acre can usually be applied profitably to the muck soil for onions. The acid muck soils are especially deficient in phosphorus, and larger amounts should be applied to them. Nitrate fertilizers can seldom be applied with profit to the muck soils. Lime cannot be applied with profit except to the acid muck soils. Manure is the best all around fertilizer for onions, but under normal conditions chemical fertilizers can be applied most economically to the muck soils. The manure should be well rotted.

The great bulk of the onions grown on the Indiana muck soils are for autumn and winter use, and for this purpose the yellow globe type is the most commonly grown, although the red globe varieties are also very popular. the white varieties are grown principally for pickling. Of the yellow type there are several varieties which are commonly grown. The Southport yellow globe is the most popular yellow variety, while the Ohio yellow globe and yellow globe Danvers are grown to a lesser extent. Of the red varieties, the Southport red globe is most popular, and the Red Wethersfield and Ohio red globe are also grown. Of the white varieties, the Southport white globe is preferred for large, mature white onions, while the white Portugal and Silver Skin are popular varieties for pickling.

Onion seed should be sown in rows 12 to 14 inches apart at the rate of 3 ½ to 4 lb. per acre as early in the spring as the ground can be worked. Frequent cultivation with wheel hoes, and two or three hand weedings are necessary. The onions are harvested about September 1. The best growers average over 500 bushels per acre, which sell at an average of 40 cents per

bushel. It costs about \$75.00 to produce an acre of onions. A large part of the Indiana crop is stored.

Onion sets and pickling onions are grown extensively in Lake county. The culture is similar to that of large onions, except that the small onions are produced by thick seeding (50 to 80 lb. per acre). Onion seed is grown successfully by some of the large growers of Indiana.

There are three insect pests, namely thrips, maggots and cutworms, which sometimes cause considerable loss to the onion growers in northern Indiana.

The onion thrips (*Thrips tabaci*) chafes off the epidermis of the leaves, principally at their base, producing yellowish, gray irregular spots on the leaves, later causing the entire leaf to dry up and die. In order to spray onion thrips successfully, high pressure (at least 100 lb.) and a fine mist-like spray which can be directed into the base of the onion leaves are necessary. A gasoline outfit or good hand pump outfit equipped with a long line of hose and extension rod is the most satisfactory type that has been used thus far. The following spray material is very efficient if it comes in actual contact with the insect:— concentrated nicotine sulphate, 5 oz.; whale oil soap, 4 lb; water, 50 gals. The spray should be applied when the thrips first appear and the onions are small and easily sprayed. It will probably have to be repeated 2 or 3 times at intervals of 10 days in order to destroy succeeding generations as they hatch.

The onion fly (*Phorbia ceparum*) lays its eggs in the sheath of the onion when the plants are very small. The eggs hatch in about 10 days and the maggots burrow into the bulbs of the onion, causing the loss of the plant. Sometimes whole fields are thus ruined. A second and sometimes a third brood appears later in the season. Field hygiene is especially important in controlling onion maggots. A new method of control devised at the Wisconsin Experiment Station, is claimed to give excellent results. This treatment, called the "poison bait spray", destroys the flies which lay the eggs. It is used as follows:— as soon as the onion seedlings appear, the first spray should be applied, and it should be repeated at intervals of 5 days or a week during the period when the flies are present. The spray consists of one ounce of sodium arsenite, 2 1/2 quarts of New Orleans molasses and 5 gals. of water. The arsenite should be dissolved in boiling water and the molasses added and thoroughly mixed. This bait must be applied, by means of a whisk broom or of a spray outfit with a coarse nozzle, in large drops along the rows so that the flies can drink it. After onions have become infested with maggots, there is nothing that will remedy the difficulty that season, but infected plants should be promptly removed and burned in order to reduce the number of insects that will appear the following season, and then the poisoned bait applied in time to destroy the flies before they can lay their eggs.

Cutworms cut off the young plants at the surface of the ground. They can be controlled by the use of poisoned bait prepared as follows:— Mix 50 lb. of wheat bran or middlings, 2 lb. of Paris green and 6 finely chopped oranges or lemons. Then add enough cheap molasses and a little water to

make a stiff dough. In the late afternoon, as cutworms feed principally at night, scatter lumps of this mixture about the size of a marble around the infested areas.

As a general rule the onion growers in northern Indiana have suffered comparatively little loss from diseases of onions. Onion mildew (*Peronospora Schleideni*) is the most serious disease and may be controlled by spraying with Bordeaux mixture.

423 - **Methods of Cultivating Trees in Relation to Soil Nitrification.** — See No. 391 of this Review.

FRUIT  
GROWING

424 - **Extension of the Limits of Cultivation of the Vine By Means of Various Hybrids** — DANIEL, L. and TEULIÉ, H., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 7, pp. 297-299. Paris, February 18, 1918.

VINE GROWING.

One of the writers, M. L. DANIEL, had shown, in 1894 (1), that, in some cases, certain qualities could be communicated to a scion or to a subject with given defects, by grafting on improving subjects. Through this information, JURIE and CASTEL obtained noteworthy improvements in their sexual hybrids both as regards quality and resistance to phylloxera. After the death of these two hybridisers, the systematic improvement of sexual hybrids of the vine was undertaken by BACO (2), who obtained in this way sexual-asexual hybrids or graft hybrids showing considerable progress on the original hybrids. Amongst these hybrids, number 24-23, improved by grafting, was noticeable for its earliness, and the authors began to grow it at Ille-et-Vilaine. After various trials and failures, the experiments made since 1914 appear successful and conclusive.

The BACO hybrids (mostly 24-23) of the authors' vineyard are planted under unfavourable conditions: the ground forms, between high buildings, a broad passage unfavourable to the concentration of heat; according to the season, the sun only reaches the plantation between 6 and 9 a. m., leaving it between 3 and 6 p. m. Nevertheless, of recent years, the grapes have been ripe at the earliest on September 26 and at the latest October 18. Still better results are hoped for when the same plants are planted on the hillside and exposed to the heat and light from sunrise to sunset.

The wine obtained is agreeable to drink, of medium quality and richly coloured.

Formerly the vine was grown all over Brittany. Since the fourteenth century, the limits of cultivation of the vine has continually receded and still recedes from north to south. With suitable plants, the former extent might be again attained, especially if cultivation were simplified, as with Baco 24-23, by the suppression of grafting, sulphuring and sulphating.

(1) DANIEL, L., Creation of New Varieties by Grafting (*Comptes rendus*, Vol. 118, 1894, p. 992). (Authors' note).

(2) BACO, Culture directe de greffage de la vigne (*Revue Bretonne de Botanique*, 192) (Authors' note).

*Analytical characteristics of the extreme harvests, 1914 and 1917.*

	1914	1917	Control vine 1914 (1).
Degrees of alcohol . . . . .	8°	8.8°	7°
Dry extract . . . . .	33.9	27.20	24.7
Dry vacuum extract . . . . .	44	32.04	30.6
Ash . . . . .	5	4.32	2.6
Sugar . . . . .	5	0.96	8.6
Total acidity, in sulphuric acid . . . . .	6.9	6.27	7.6
Fixed acidity . . . . .	6.4	5.80	6.9
Volatile acidity . . . . .	0.5	0.47	0.7
Total tartaric acidity . . . . .	4.5	4.97	2.7

From experiments cited and others in progress it seems possible that the vine might be cultivated over a larger area than the present one. Such an extension would obviously have considerable economic and social consequences.

425 - *Vinifera Grapes in the State of New York, U. S. A.* -- ANTHONY, N. D., under the direction of HEDRICK, U. P., in *New York Agricultural Experiment Station, Bulletin* No. 432, pp. 81-105. Geneva, N. Y., April, 1917.

For two hundred years vain attempts have been made to grow the European grape, *Vitis vinifera*, in eastern America. The end of these attempts was hastened by the discovery of satisfactory native sorts such as Isabella and Catawba. In the meanwhile, very different results were being secured on the Pacific coast where, in southern and central California, the *Vinifera* grapes found congenial conditions.

It has been found that there were four chief reasons for the failures to grow grapes in the east : — 1) the downy and powdery mildews, 2) black-rot, 3) phylloxera, and 4) winter injury.

Experimental culture of the European grape was undertaken at Geneva Station in 1900 when cuttings or plants of 19 varieties were received. In 1911, cuttings of more than 70 varieties were grafted upon a collection of Station seedlings ranging from 6 to 10 years old. Satisfactory results were obtained.

As a result of the work at Geneva certain recommendations can be made for New York state. One of the chief difficulties is to obtain plants of the desired kinds. Such as can be obtained are not always on resistant roots. For this reason the grower should know how to graft cuttings on phylloxera resistant roots such as *Vitis vinifera*, which can be done either in the nursery or in the vineyard.

In planting *Vinifera*s less space is required than with the native sorts ; rows 6 ft. apart and plants 6 ft. in the row give satisfactory results. In the east the vines should be supported with the regular 2-wire trellis. Because of the necessity of bending the trunk to the ground for winter protection,

(1) It seemed of interest to contrast the analysis of an ordinary wine, harvested in the department of Lot, at Bétaille, right bank of the Dordogne, and made from a mixture of Clinton, Canada, Othello in smallest part, and several other hybrids in very small amount. The 1914 analysis was made by M. FERRIER, that of 1917 by M. C. LAURENT (Author's note)

a replacing spur should be left at the base of the trunk to use in forming a new trunk when the old one becomes too stiff. The main trunk should be carried to the lower wire and 2 fruit canes and renewal spurs provided for. The young shoots that spring from these canes and spurs grow upright to the second wire, when they are pinched off and tied. This gives stockier and more mature canes for the following season. Cheap winter protection is obtained by bending the vines to the ground and covering with soil.

The chief value of the Vinifera in New York state is as a home-garden grape for the amateur, for the commercial grower supplying local markets demanding high quality, and for the plant-breeder seeking to obtain improved varieties.

Most of the Vinifera varieties have originated in regions with a longer season and a much warmer climate than that of New York and many kinds included in the tests at Geneva have been discarded because, even in the most favourable seasons, they have not reached maturity.

The varieties are classed in 4 groups: — 1) Desirable varieties for the grape regions of the State for a) the table and b) wine; 2) sorts worthy of testing in the more favourable parts of the State for a) table and b) wine; 3) kinds still on probation; 4) varieties of little or no value in the State.

After having given an historical account and discussed the work at the Geneva station, the author classifies the varieties in the following manner: —

1) *Desirable varieties for the grape regions of the State of New York.*

a) *For table use.*

Bakator  
Golden Chasselas  
Chasselas rose  
Chasselas Besson  
Fcher Szagos  
Kuristi Mici  
Lignan Blanc  
Muscat Hamburg  
Early Black Muscat  
Muscat Saint Laurent  
Grey Pinot  
Rosuki

b) *For wine*

Blue Portuguese  
Beclan  
Kadarka  
Mennier  
Black Pinot  
Pinot de Pernan  
White Pinot  
Teinturier

2) *Varieties worth testing in the more favourable parts of the State.*

a) *For table use.*

Acton  
Cinsaut  
Early Frankenthal  
Gradiska  
Irlan  
Mamelon  
Poulsard

b) *For wine.*

Berzemino (Marzemino)  
Calmette  
Grey Chauché (Chaouch)  
Franken Reesling (Sylvaner)  
Large Sauvignon  
Slankamenka.  
Syrah

3) *Varieties still on probation.*

Carignane	Oliver de Seres
Chardonnay (Chabl's)	Quagliano
Lahn Traube (Van der Laan Traube)	Savagnin Rose (Gewurztraminer or
Malaga	Red Traminer)
Mammolo Toscano	Semillon
Mantno di Pila	Servan Blanc (Servant)
Monica (Canaiolo)	Steinschiller (Rother Steinschiller)
Muscat of Alexandria	Sultanina
Black Hungarian Muscat	Vallepenas
Large Early Black Muscat	Zinfandel

4) *Varieties of little or no value in the State.*

Angelino	Pintendo
Aramon	Green Hungarian
Black Alicante (Black Saint Peter)	Grenache
Black Damascus	Malvasia
Black Morocco (Ribier)	Malvasia Rosario
Black Muscat (Jura Muscat)	Millennium
Cornichon Violet	Petio Ximines (Pedro Jimenes)
Elbl ng (Burger)	Schira Izouli
Ferrare	White Muscat (Muscat Frontignan).
Flame Tokay	

426 — *Vine Growing in Crete.* — See No. 375 of this *Review*.

427 — *Winter Injury of Grapes in Kentucky, U. S. A.* — See No. 384 of this *Review*.

## FORESTRY

428 — *The Arboretum of M. P. de Vilmorin at Pezanin (Saône-et-Loire, France), and the Results Obtained there.* — MORRET, S., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 5, pp. 175-186. Paris, February 6, 1918.

About fifteen years ago M. PHILIPPE DE VILMORIN established in Central France, in Charollais, at Dompierre-les-Ormes (Saône-et-Loire), a tree nursery for studying on a large scale under forest conditions, the acclimatation and utilisation of the forest and ornamental trees, cultivated in his experimental grounds at Verrières (Seine-et-Oise).

The estate, called "Pézamin", is at an altitude of 1276 feet. Forty-four acres of hills are at present planted, all of which slope down to a lake covering 10 acres. The soil is granitic, composed of rock more or less worn away by exposure, the finer portions of which have accumulated in the lowest parts and form the vegetable soil. The soil is very permeable, very poor in lime and clay, and subject to drought in the sloping parts more exposed to the sun. As in many mountains, moist portions are found here and there, giving very vigorous growth. By reason of the altitude the climate is cold, and there is snow for a great part of the winter.

The first plantation was made in 1903, and planting was continued regularly in autumn every year up to 1915. Since the death of M. DE VILMORIN the experiments have been continued by M<sup>me</sup> DE VILMORIN and the

author. Very interesting results have already been obtained. Over 50 000 young trees have been planted, distributed as follows :

	Trees or bushes with deciduous or persistent leaves	Conifers
General . . . . .	91	32
Species or varieties. . . .	789	206

A fairly large number of trees proved insufficiently hardy, and incapable of thriving under the harsh soil and climatic conditions ; these disappeared or only live in a weak state. Unfortunately the war has not allowed a complete list of these trees to be made yet. The winter 1916-17 caused the loss of many trees which had resisted till then, especially of several *Araucaria imbricata*, which froze completely.

As a rule deciduous trees did much less well at Pézanin than the conifers. Nearly all the Juglandaceae succumbed ; only a few *Juglans Vilmoriniana* managed to take hold in one part of the nursery. All the *Carya* died. The *Pterocarya* and *Juglans* which have survived have lost all their stem and are growing in bushes from the base. The *Catalpa*, *Paulownia*, some *Acer*, *Aesculus* and *Pavia*, *Fraxinus*, *Gleditschia*, *Tilia*, many bush Leguminaceae, and various Rosaceae, are doing fairly well, usually growing from the foot instead of forming a stem.

On the other hand, certain trees, especially common acacia, birch, hornbeam, and *Planera*, in particular, then oaks, willows, and alders, do more or less well, according to the species to which they belong and the place in which they are planted ; the depth of the soils, which varies greatly in the different parts, naturally has much influence on their vigour. All oaks do well at Pézanin, but the rapidly growing American species, especially *Quercus coccinea*, *Q. palustris*, *Q. rubra*, *Q. tinctoria*, etc., grow as rapidly as the willows when their roots find a little depth or fissures in the underground rocks ; their colours in autumn are very brilliant. Some *Quercus dentata* (*Q. Dainio*), grown in a fresh position, have developed exceedingly well after having refused to grow for several years.

Some trees that are usually weakly elsewhere, particularly at Vernières, have developed surprisingly well. This is the case with : *Dirca palustris*, the curious "leatherwood" tree, whose branches are so supple that they can be rolled up like straps ; with *Nothofagus antarctica*, which grows almost as vigorously as an elm, which it resembles by its foliage ; *Halesia tetraptera*, the "silver-bell" tree which flowers and fruits in abundance ; *Hamamelis virginica* was in flower in November 1917, at planting time ; various *Rhododendron* crosses, planted in numbers in a clearing, have taken root and are growing strongly ; on the contrary, *Azalea amœna* could not resist the great cold, whilst *Daphne Mezereum album* is growing well, being apparently well suited to the conditions there.

In general the conifers, which form the basis of the plantations, have done the best. Besides the forest trees common to the region, many spe-

cies, having found suitable surroundings there, have grown up into fine saplings. Shoots over 3 feet high are not uncommon with the Douglas fir. *Abies balsamea* has found so good a position, fresh and with a northern exposure, that some strong specimens planted in 1907 are now nearly 26 feet high.

*Abies arizonica argentea*, the famous "cork fir" now diffused in Europe for some 15 years, does splendidly; its thick and conical habit of growth, together with its fine glaucoustint, make it one of the finest conifers in the plantation. *Abies grandis* (Vancouver fir) competes in height with the silver fir and wins by its massive branching system which spreads curiously before it begins to thicken. *Abies concolor* and *A. lasiocarpa* are in perfectly suitable surroundings, and are noticeable for their fine stature and their distinctive blue colouring. *Abies Nordmanniana*, *A. cephalonica* and several other species, do very well, even *A. Pinsapo*, a southern tree; on the contrary, however, *A. cilicica* which begins vegetation early, freezes in spring, and becomes stiff and spindle-shaped.

Several Piceas succeed at Pézanin. Besides *Picea excelsa*, grown as a forest tree, the following may be noted: — *P. pungens* (*P. Parryana*) and its very ornamental glaucous forms; *P. Morinda*, whose young shoots are liable to freeze in winter; *P. orientalis*, with its small, close, dark-green foliage, it is very distinctive and grows very well; *P. sitchensis* (*P. Menziesii*), much finer than in the Paris region, too hot and dry for it during summer. On the other hand, *P. ajanensis* does not do at all; *P. Alcockiana* which it was long mistaken, freezes in spring; and *P. Omorica*, so remarkable at Verrières, remains very poor.

The Atlas cedar and its silvery form, from which such fine colour contrasts were expected, are weakly and without any ornamental effect. The slow-growing bushy foliage of the cedar of Lebanon seems to indicate that the soil is neither sufficiently deep nor sufficiently fertile for it, while the heat is insufficient.

The common larch (*Larix europaea*) is common in the district, and its wood is in great request for its straightness and its quality, superior to that of forest pines; most of the other species do equally well there, including *Larix occidentalis*, as yet still rare in plantations, and whose branches seem more developed than those of the former. But *Larix leptolepis* is much better than the related species for the surprising rapidity of its development, which rivals that of the Douglas fir, and by its fine, straight, clear bole.

Here as elsewhere, the adaptability of the various species of pine seems much more unequal than that of the firs. *Pinus sylvestris* and *Pinus Laricio* are the commonest in the region, where they are of almost equal forest value, the latter giving more wood than the first, but of less value, at any rate as a young tree. *Pinus Banksiana* and *Pinus rigida* do very well, but not so well as *P. sylvestris*; they are probably preferable to the latter for dry places. *Pinus excelsa* and *P. Strobus* do equally well in Charollais, but their white, soft wood, of low commercial value, hinders their wider growth. *Pinus densiflora* and *P. Thunbergii* which, in Japan, represent our



*P. sylvestris* and *P. Laricio*, are of no forestal interest for the region, for they branch and become bushy early, and their branches bend and break easily under snow. *Pinus ponderosa* and its varieties are weakly and its shoots are attacked by *Tortyx buoliana* as is the case in many places. Most of the other pines do not grow very well, and are only of interest in a collection.

429 — “Peh-Muh” and “Xun-Peh-Muh”, Trees in Tonkin New to Science. — BUNGO-HAYATA, in *Bulletin économique de l'Indochine*, Year XX, New Series, No 126, pp 435-440 + 1 Plate of 14 Figs. Hanoi-Haiphong, September-October, 1917.

The author's attention was drawn to a Chinese poem, the “Shu-hai-ko” (Song of Great Forests) of CHAO-OU-PEI, who pictures an immense forest composed of trees, the description of which shows them to be Coniferae, resembling the genus *Cupressus*. The author came to the conclusion that these trees were only to be found in the mountainous districts bordering on Yunnan and Tonkin, and came to Chapa (Tonkin) to study them on the spot. They belong to two species, known locally as “Peh-Muh” and “Xun-Peh-Muh”.

The conifer “Peh-Muh” is a species of new genus, *Fokienia*, formed in 1911 by Messrs. A. HENRY and THOMAS. The author calls this species *Fokienia Kawaii* Hay, and gives a description of it in Latin.

The conifer “Xun-Peh-Muh” appears to be a new species of the genus *Podocarpus* and belongs to the small section *Dacrycarpus*. The author proposes to call it *Podocarpus Kawaii* Hay, and describes it in Latin.

The forests formed by these two species are found over a considerable area in the mountain district (Chapa is at an altitude of 4 920 feet) and have never been cut (1).

430 — The Forests of the Island of Cyprus. — See No. 376 of this Review.

431 — Fertility and Population of the Sandy Pine Plains of Northern Wisconsin. — See No. 385 of this Review.

## LIVE STOCK AND BREEDING.

432 — Experimental Feeding of Sheep with Two Poison Plants: Wild Indigo (*Swainsona luteola*) and Native Wild Tobacco (*Nicotiana suaveolens*) in New South Wales. — CLELAND, J. B. and MC DONALD, A. H. E., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 10, pp. 735-739. Sydney, October, 1917.

The injurious effects on sheep caused by eating certain species of *Swainsona*, usually called Darling Pea, have long been known. The species specially concerned are *S. galegifolia* and *S. Greyana*; *S. lassertifolia* in Flinder's Island, Bass Strait, and *S. procumbens* or Broughton Pea, in South Australia are also suspected. Up to the present, analysis has not shown the presence of any poisonous substance in these plants.

(1) With regard to the wood and its possible use the author refers the reader to the *Bulletin économique de l'Indochine*, New Series, No. 98, p. 708, Sept.-Oct. 1912, “Coffin Woods in the Hà-giang District”, by BONIFACY, and No. 100, p. 106, Jan.-Feb., 1913, “Further Notes on Coffin Woods”, by BONIFACY and CH. LEMARIE, in which the authors discuss the conifers of the north of Tonkin (“peu mou”, “cha mou”, etc.), the wood of which is largely used by the Chinese for making their coffins (Ed.).

HYGIENE

*The Agricultural Gazette of New South Wales* has published papers on this subject. The most important experimental results were those contributed in 1897 by Dr. C. J. MARTIN from experiments in which six sheep were fed exclusively on *S. galegifolia*, salt and water. He observed the symptoms (nervous disorders, anaemia), attributed by herdsmen to feeding on this plant. In adult sheep definite symptoms started when the animals had eaten the plant for 3 to 4 weeks. Under the experimental conditions the sheep lived for about 3 months, but were very weak. Animals which received normal fodder after being fed on *S. galegifolia* for 4 to 6 weeks, and before the symptoms of poisoning were fully established, recovered completely. If, however, paralytic symptoms had already occurred, a return to normal food did not cure, but only prevented the animal from becoming worse.

The poison in *S. galegifolia*, if there be any, is, therefore, weak and cumulative, or possibly it may cause a "deficiency disease". If this second hypothesis be true completing the ration by foods rich in vitamins would be sufficient to prevent the disease. In the experiments described brewers' yeast was used as a supplement. The results were not conclusive, but seemed to show that the disease is not a deficiency one. The experiments were made with *S. luteola*, locally called "indigo", at the Coonamble Experiment Farm. Two sheep fed exclusively on 9 lb. per head daily of this plant became ill; two other subjects which, besides the same ration of *S. luteola*, also received  $\frac{1}{2}$  pint of brewers' yeast per day, also became ill. The experiment was started on September 1. The first symptoms occurred on October 11, a few days after the plants fed had begun to fructify. Feeding with indigo was stopped on October 27 and normal food supplied. One of the sheep fed exclusively on indigo died; the other of the same group and the two which had also received yeast, improved, and were still alive on March 20, though they had the peculiar appearance known as "crazed".

The same, or a similar, disease is known in America, where it is called "Loco disease"; it is caused especially by *Astragalus mollissimus* and *Oxytropis Lambertii*.

Native wild tobacco (*Nicotiana suaveolens*) has long been suspected to be poisonous. It undoubtedly contains active principles capable of causing serious and, perhaps, fatal results if eaten in sufficiently large quantities. An experiment was started on September 25 at the Coonamble Experiment Station to determine whether, under natural conditions, sheep can eat a sufficient quantity of it to cause ill effects. The sheep showed a strong antipathy to the tobacco, and would only accept it chopped up with wheat chaff; they ate, on the average, 1  $\frac{1}{2}$  lb. per head daily. Two animals given this ration till November 27 showed no signs of illness. The experimental amount of this plant seems, therefore, to be harmless.

433 - **Parasitic Nematodes in the Belgian Congo.** — RAILLET, A. and HENRY, A., in the *Bulletin de la Société de Pathologie exotique*, Year XI, No. 2, pp. 82-86. Paris, February 13, 1918.

A collection brought from the Belgian Congo by M. VAN SAGEGHEM and studied by him in the Parasitology Laboratory at Alfort, and another brought

together between 1907 to 1910 at the Leopoldville Laboratory by MM. BRODEN and RODHAIN, have been used by the writers to make up the following list:—

I. — Fam. STRONGYLIDÆ: A) Sub-fam. ŒSOPHAGASTOMINÆ: *Œsophagostomum* sp. (gut of a black monkey); *Œs. columbianum* (intestine of sheep and goats); *Œs. radiatum* (intestine of cattle).

B) Sub-fam. STRONGYLINÆ: *Strongylus equinus* (intestine of horse); *Ancylostoma duodenale* (man); *A. caninum* (dog).

C) Sub-fam. BUNOSTOMINÆ: *Bunostomum trigonocephalum* (intestine of goat); *B. phlebotomum* (intestine of calves); *Necator americanus* (intestine of man); *Gaigeria pachyscelis* (intestine of sheep); *Stephanurus dentatus* (body cavity of porker).

II. — Fam. TRICHOSTRONGYLIDÆ: *Haemonchus contortus* (intestine of cow, sheep, goat); *Trichostrongylus colubriformis* (intestine of sheep, goat).

III. — Fam. METASTRONGYLIDÆ: *Megastrongylus elongatus* (bronchi of pig); *Dictyocaulus* sp. (bronchi of monkey *Macacus*).

IV. — Fam. ASCARIDÆ: Sub-fam. ASCARINÆ: *Belascaris marginata* (intestine of dog).

V. — Fam. OXYURIDÆ: Sub-fam. OXYURINÆ: *Oxyuris equi* form *mastigodes* (intestine of horse).

VI. — Fam. HETERAKIDÆ: Sub-fam. HETERAKINÆ: *Ascaridia perspicillum* (intestine of fowls and pullets); Sub-fam. SUBULURINÆ: *Subulura distans* (intestine of monkey).

VII. — Fam. SPIRURIDÆ: A) Sub-fam. SPIRURINÆ: *Habronema macrostoma* (stomach of a mule imported from Teneriffe).

B) Sub-fam. GONGLYLONEMINÆ: *Gongylonema verrucosum* (mucosa of a goat's stomach).

C) Sub-fam. ARDUENNINÆ: *Streptopharagus pigmentatus* (intestine of a monkey).

VIII. — Fam. THELAZIIDÆ: *Oxyuris mansonii* (conjunctival cul-de-sac of fowls).

IX. — Fam. ACUARIIDÆ: Sub-fam. PHYSALOPTERINÆ: *Physaloptera abbreviata*? (stomach of an iguana).

X. — Fam. DRACUNCULIDÆ: *Dracunculus dahomensis* (conjunctive tissue of a python).

XI. — Fam. FILARIIDÆ: *Loa loa* (man); *Dirofilaria corynodes* (subcutaneous conjunctive tissue of monkey); *Setaria labiato-papillosa* (body and peritoneal cavities of cattle); *S. equina* (peritoneal cavity of horse).

XII. — Fam. TRICHURIDÆ: Sub-fam. TRICHURINÆ: *Trichuris ovis* (intestine of a goat).

In M. VAN SAGEGHEEN'S collection there are also: some nematodes from wild animals, still being studied, and also an *Evansia* and *Murshidia* of the African elephant; an acanthocephalus, *Gigantorhynchus hirundinaceus*, of the intestine of the pig and a trematode, *Gastrodiscus aegyptiacus*, from the intestine of the horse.

- 434 — **The Culture of the Parasite of Epizootic Lymphangitis and the Experimental Production of the Disease in the Horse, in France.** — BOQUET, A. and NÈGRE, L., in *Comptes rendus des Seances de l'Académie des Sciences*, Year CLXVI, No. 7, pp. 308-311. Paris, February 18, 1918.

Epizootic lymphangitis ("African farcy") is caused by a specific parasite discovered by RIVOLTA and placed by him in the Blastomycetes — *Cryptococcus farciniosus*. In spite of the researches of TOKISHIGE, MARCONI and SANFELICE the nature of the parasite was still doubted since, of late, certain authors considered it to be a protozoon.

The authors have shown, by their researches, the nature of RIVOLTA's cryptococcus by the growth of the parasite as mycelium in cultures which could be propagated and by the experimental production of the disease by inoculating these cultures into the horse. The experiments are fully described. Further work on vaccination and bacteriotherapy by means of heated cultures is in progress.

- 435 — **Immunisation of Goats against Malta Fever by Vaccination.** — See No. 381 of this Review.

- 436 — **Contagious Septicaemia of Swine in Morocco.** — VELU, H. (Laboratoire de Recherches du Service de l'Élevage du Maroc), in the *Bulletin de la Société de Pathologie exotique*, Year XI, No. 2, pp. 117-124. Paris, February 13, 1918.

Clinical observations have shown that, in Morocco, there exists a very contagious disease of swine, which chiefly attacks young or middle-aged subjects, and is characterised by lesions resembling those of septicaemia (pulmonary hepatisation, tumefaction and haemorrhagic infiltration of the lymphatic ganglia, congestion and haemorrhagic foci on the skin and serous membranes, but without lesions of croup or diphtheria).

An ovoid bacterium, which is probably *Pasteurella*, was found to be almost always present in the bronchial ganglia, pulmonary lesions, and the exsudates.

Experimental study has shown that: — 1) this ovoid bacterium is clearly pathogenic for the pig and, on inoculation it reproduces the disease; 2) contamination is carried out by faecal matter; 3) infection takes place through the digestive or respiratory channel.

CONCLUSIONS. — Severe epizooties of swine, with varying symptoms, and which flourish in certain piggeries of Chaouia, seem exclusively due to a *Pasteurella*, the presence of which can easily be shown in all the sick animals. The confirmation of these facts by further research would be of great importance. These simple infections could then be combatted under good conditions, by means of the usual processes of vaccination, serotherapy or bacteriotherapy.

- 437 — **Avian Blood Parasites of French Guiana.** — LEGER, MARCEL (Institut d'Hygiène de Cayenne), in the *Bulletin de la Société de Pathologie exotique*, Year XI, No. 2, pp. 124-130. Paris, February 13, 1918.

I. — **TRYPANOSOMES:** — *Trypanosoma ardeae* n. sp., parasite of *Nyctanassa violacea*; *T. ardeae* var. *major* n. var., parasite of *Ordea cerulescens*; *Trypanosoma* sp., parasite of *Butorides striata*.

II. — HAEMOPROTEUS: — six undetermined species of *Haemoproteus* parasites respectively of *Falco sparverius*, *Anas moschata*, *Tringa atricapilla*, domestic pigeon, *Columba rufina*, *Scops brasiliana*.

III. — MICROFILARIAE: — six undetermined species respectively parasites of *Nyctanassa violacea*, *Rallus longirostris*, *Crypturus cinereus*, *Planesticus phacopygus*, *Ardea coerulescens*.

IV. SPIROCHAETAE: — *Spirochaeta gallinarum*, the cause of disastrous epizooties, devastating whole roosts, and appearing, so it seems, every 4 or 5 years. Fowl spirochaetosis had not previously been identified in Guiana. The pathogenic agent was discovered in Martinique by SIMOND, AUBERT and NOC in 1909 and in Brazil by MARCHOUX and SALIMBENT in 1913.

The author observes that:— 1) according to his observations haematozoa are less common in birds in Guiana than in Tonkin, French Soudan, and even in France (Corsica and Reims region); 2) he has never found a *Leucocytozoon* during examination of more than 500 birds, belonging to 78 species of 27 families; and as the numerous haematological researches of BRIMONT in Guiana, CARINI and collaborators in Brazil, and ITURBE and GONZALES in Venezuela have also always given negative results as regards this, it seems doubtful if the genus *Leucocytozoon* is really represented in South America.

438 — **Chicken-pox in Poultry, in Canada.** — UPTON, H. E., in *Province of British Columbia, Department of Agriculture, Live Stock Branch, Poultry Division, Circular Bulletin No. 20*, pp. 5, Figs. 5. Victoria, 1917.

Chicken pox is usually accompanied by other diseases such as diphtheric croup, canker, and swollen head. As long as the affection stays on the skin of the head very little trouble is caused.

SYMPTOMS. — The disease shown itself in 2 forms: — 1) Chicken pox (*Epithelioma contagiosum*), causing nodules and ulcers on the head, especially on parts not well feathered; 2) small diphtheric patches appearing in and around the mouth, on the tongue, and at the mouth of the windpipe; if the disease is allowed to develop, the fowl will be prevented from either eating or breathing. The patches also appear on the side of the face; they may reach the eyes and cause blindness.

PREVENTIVE MEASURES. — The poultry house should be disinfected and kept clean; the poultry runs, the hands and shoes of those handling the stock, should be also disinfected and cleaned. Diseased birds should be isolated and dead birds burned. Prevent pigeons and other birds from walking on contaminated ground and thus spreading the disease. An excellent germicide to use in the drinking-water can be prepared by quickly stirring 2 oz. oil of sassafras into 2 gallons water; pour and mix slowly 2 fluid ounces sulphuric acid in this mixture; to use, add one tablespoonful of the mixture to each gallon of drinking water.

TREATMENT. — The fowls should be kept housed during the winter, and the runs covered with quicklime. Change the straw and litter in the houses, burn the dirty straw and disinfect the roosts and drop boards with carbolic acid.

The Poultry Division of the Department of Agriculture of British Columbia have carried out experiments in an endeavour to cure and prevent the disease by vaccination. The writer vaccinated about 3 000 birds ranging from five weeks to three years in age. Control birds were left in each flock; 40 % died. Some flocks were vaccinated with vaccine made from scabs only ; others with vaccine made from scabs and cheesy exudate, or from scabs and exudate mixed together then attenuated, or attenuated separately then mixed. The best results were obtained with the vaccine prepared from scabs and exudate ground together then attenuated. With 5- to 8-week old chicks (the majority showing signs of disease after severe chilling), good results were obtained by injecting  $\frac{1}{2}$  cc. of vaccine twice at an interval of 3 to 4 days. In some very bad cases, expected to die, 2 cc. were injected and complete recovery obtained. No bad effects were noticed, though 3 birds died owing to emaciation before the injection. Egg production was not affected in any way.

The scabs and exudate should be removed with a sterile pair of scissors and tincture of iodine applied to the exposed surface.

The method of preparing the vaccine is as follows: — One half gram of chicken pox scabs and exudate are ground in a sterile mortar with 100 cc. of physiological salt solution. This material is poured in a flask, stoppered, placed in a water bath, and attenuated at 55° C. for one hour. Filter into a sterile flask and wash the filter with the rest of the salt solution. It is essential that the vaccine be used as soon after preparation as possible, or it will deteriorate and give poor results.

ANATOMY  
AND  
PHYSIOLOGY :  
GENERALITIES

439 — **The Chemical Composition of the Placenta of the Cow.** — FENGER, F. (Research Laboratory in Organotherapeutics of Armour and Company, Chicago), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 1, pp. 19-23. Baltimore, Md., February, 1917.

The constituents of the uterine placenta seem to remain comparatively uniform throughout gestation, while the foetal placenta varies considerably in composition at different stages of pregnancy. This is well shown by the results obtained by the author and summarized in the appended table. The results show that the maternal cotyledons contain less moisture and more protein and fats, phosphatides, etc., than their corresponding placentulas. The older uterine cotyledons contain more potassium and less sodium than the younger, but otherwise the variations in the mineral constituents are comparatively slight at the two selected stages of pregnancy. The young foetal placenta contains much more chlorine and considerably more sodium and calcium and less of the other inorganic constituents than the older foetal placenta. It is evident, therefore, that chlorine, sodium and calcium are of vital importance in early foetal life. Later, during the rapid growth periods, the amounts of these three elements diminish while the quantities of phosphorus, sulphur, potassium, iron, and magnesia increase. The 3 to 4 months old foetal placentulas, which are of a pale pink colour, contain only about  $\frac{1}{3}$  the quantity of iron that is present in the older and dark red foetal placentulas. This indicates that the amount of haemoglobin in the foetal blood is small during the earlier stages of pregnancy, but in-

creases in direct proportion to the growth of the foetus. All the samples examined by the author gave negative tests for epinephrin and iodine.

*Composition of the foetal placenta at various phases of gestation.*

	Maternal placentulas (uterine cotyledons) of 3-4 months	Maternal placentulas (uterine cotyledons) of 7-9 months	Foetal placentulas (foetal cotyledons) of 3-4 months	Foetal placentulas (foetal cotyledons) of 7-9 months
<i>Fresh tissue:</i>				
Average weight . . . . . gm.	13.6	36.6	10.4	27.6
Moisture . . . . . %	83.20	82.00	88.40	84.20
Petroleum ether-soluble substances . . %	1.45 *	1.48 *	0.69 **	0.84 **
P <sub>2</sub> O <sub>5</sub> in petroleum ether-soluble substances %	2.10	2.22	2.50	1.51
Phosphatides (lecithin) in fresh tissue . %	0.34	0.37	0.19	0.14
Desiccated fat-free material . . . . . %	15.35	16.52	10.91	14.96
<i>Desiccated fat-free material:</i>				
Moisture . . . . . %	5.55	4.45	7.05	5.05
Ash . . . . . %	6.50	6.38	10.25	6.95
Total nitrogen . . . . . %	13.17	13.41	12.03	13.18
Protein (N × 6.25) . . . . . %	82.30	83.81	75.19	82.47
Phosphoric acid (P <sub>2</sub> O <sub>5</sub> ) . . . . . %	3.95	3.77	3.92	3.65
Sulphuric acid (SO <sub>4</sub> ) . . . . . %	1.85	1.79	1.56	1.62
Chlorine (Cl) . . . . . %	0.17	0.15	2.06	0.49
Potassium (K) . . . . . %	1.51	1.71	1.87	1.44
Sodium (Na) . . . . . %	0.85	0.71	1.73	0.96
Iron (Fe) . . . . . %	0.014	0.02	0.028	0.063
Calcium (Ca) . . . . . %	0.179	0.179	0.457	0.159
Magnesium (Mg) . . . . . %	0.115	0.127	0.109	0.120

\* Yellow, sem-solid, lecithin odour.

\*\* Dark orange, sem-solid, lecithin odour.

440 - **Foetal Athyrosis: A Study of the Iodine Requirement of the Pregnant Sow.** — SMITH, ENNIS, G. (Montana Experiment Station, University of Montana, Bozeman), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 2, pp. 215-225, 3 Tables. Baltimore, March, 1917.

The paper describes an investigation into hairlessness and enlarged thyroid glands, found, in certain parts of Montana, among sows, sheep, cattle and mares (1).

The author obtained the following results experimentally: —

An iodine deficiency during the gestation period causes a lack of function and hyperplasia of the foetal thyroid, causing arrested development of the foetus. If more iodine were fed to the pregnant animals in many parts of the United States, their young would be more healthy and vigorous. Foetal athyrosis shows that there is a direct relation between the physiologically active constituents of the thyroid and growth of the epidermal appendages. An abundant secretion of the foetal thyroid during the later stages of the intra-uterine life is essential to the normal development of the foetus.

(1) See R. March, 1918, No. 305. (Ed.)

FEEDS  
AND FEEDING

441 - The Availability of the Energy of Food for Growth. — MOULTON, C. R., in *The Journal of Biological Chemistry*, Vol. XXXI, No. 2, pp. 389-394, 3 Tables. Baltimore, August, 1917.

Experiments on the use of food have been conducted at the University of Missouri Agricultural Experiment Station, and some data have been obtained upon the relative amount of the energy of the food which may be recovered in flesh gained. The animals used were mature beef steers, 2 or 3 years old, of the Shorthorn breed; they were as alike in weight, previous method of treatment and type as is possible. The ration consisted of 5 parts of mixed grain (8 parts of maize meal and 1 of cold-pressed linseed meal) to 2 of alfalfa hay.

The digestibility of the ration was determined by digestion trials. The cost of maintaining the animals at constant weight was determined by extended maintenance trials. After the maintenance trial steer 18 was slaughtered for analysis; the other 2 were fattened, steer 48 to prime condition, steer 121 to a condition of 40 to 50 days under prime; they were then slaughtered and analysed. Table I shows the composition of the gain of weight. In calculating the thermic equivalent of the fat and protein, the value of 5,6776 calories per gm. was used for the protein, and 9,4889 for the fat. The equivalent metabolizable energy for the ration was found by ARMSBY's method (1) to be 3,803 calories per kg. of digestible organic matter. The data are given in Table II.

The metabolizable energy that may be used for production of flesh is that amount over and above the needs for maintenance. Using the average weight of the animal while on maintenance and the maintenance cost found by trial for each, the cost of maintenance during the full feed period was calculated. The amounts of energy required for maintenance at different body weights are proportional to the body surfaces, *i. e.*, roughly to the two-thirds power of the body weights. In previous work (*J. Biol. Chem.*, 1916, XXIV, 299) the author has shown that the surface area of a thin or medium fleshed steer is more nearly proportional to the  $\frac{5}{8}$  power of the weight, while with very fat steers the  $\frac{5}{8}$  power should be used. Both the  $\frac{5}{8}$  power and the  $\frac{5}{9}$  power were used in the calculations (the latter is used in Table II) and a difference of 0.25 % of the net energy cost. (2) of

(1) See *B. June*, 1915, No. 625 (*Ed.*).

(2) Food which enters the animal body has a certain amount of total energy, called the heat of combustion. This energy is different for different feeds. Of this total energy the animal loses part by way of the faeces in the undigested food residues, part by way of the urine in incompletely oxidized bodies, and part by way of combustible bodies voided. The amount over and above these losses is called the metabolizable energy. Not all of this metabolizable energy is available for the use of the animal body in either maintenance or growth. There is a loss due to the work of digestion, mastication, and movement of the food through the digestive tract. There is also a further loss due to a stimulated metabolism upon the absorption of digestible substances from the alimentary tract. There may be a slightly greater muscular activity due to the increased food consumed. All this energy is converted into heat and lost from the body. What is left of the metabolizable energy after these second losses are accounted for is called the net, or available, energy. This may be used for production of work, or may be stored in the animal body in the form of protein, fats or other body substances.

(Author)



a pound of gain for Steer 18 and 1.5 % for Steer 48 was found. The true value would lie between that given in Table II and a value smaller by the above percentage amounts. The error could therefore be hardly more than half that shown, or about 0.75 % of the total for Steer 48. The error in the calculation of the per cent. of available energy would be about double this error. The error is so small that a more complex method of calculation is not required.

TABLE I. — *Composition of Gain. Energy Stored in Flesh Gained.*

	Steer 121		Steer 48	
	Flesh gained (estimated)	Composition of gain (estimated)	Flesh gained (estimated)	Composition of gain (estimated)
	gm.	per cent.	gm.	per cent.
Warm empty weight . . . . .	211 726	—	417 900	—
Water . . . . .	84 174	39.76	123.372	29.52
Fat . . . . .	97 626	46.11	248 246	59.40
Nitrogen . . . . .	3 981	1.88	5 707	1.37
Protein . . . . .	24 879	11.75	35 667	8.54
Ash . . . . .	4 161	1.97	7 084	1.70
Phosphorus . . . . .	597	0.28	1 155	0.28
Energy in fat, calories . . . . .	926 359	—	2 355 601	—
Energy in protein » . . . . .	141 252	—	202 502	—
Total energy stored » . . . . .	1 067 611	—	2 558 103	—

TABLE II. — *Gross and Net Cost of Gain,  
Per Cent Availability of Energy.*

		Steer 121	Steer 48
Length of period. . . . .	days	153	567
Weight at beginning . . . . .	lb.	764	842
"    "    end . . . . .	"	1 266	1 805
"    gained . . . . .	"	502	963
Grain eaten daily . . . . .	"	18.34	16.93
Hay . . . . .	"	7.21	7.01
Organic nutrients . . . . .	"	3 398	11 821
Digestible organic nutrients . . . . .	"	2 267	7 860
Metabolizable energy . . . . .	therms	3 900	13 519
Energy per lb. gain . . . . .	"	7.73	14.03
Average weight of animal . . . . .	lb.	1 041	1 384
Energy per 1000 lb. for maintenance . . . . .	therms	12.14	12.73
Total energy for maintenance . . . . .	"	1 900	8 646
Energy above maintenance . . . . .	"	2 000	4 873
Energy above maintenance per lb. of gain . . . . .	"	3.98	5.06
Energy recovered in gain . . . . .	"	1 067.6	2 558.1
Metabolizable energy recovered . . . . .	%	53.39	52.49

The results of the calculations, given in Table II, show a much higher productive energy cost of each pound of gain for the very fat steer than for the medium fat steer. Steer 48 gained about 29 % more fat than Steer 121 the productive energy increased in about the same proportion (27 %).

In the tissues gained by these animals, one recovered 53.39 % of the metabolizable energy consumed above maintenance and the other recovered 52.94 %. Thus it is seen that the energy saved was about the same in both animals. Since this proportion of the energy is recovered it may be said that this is a measure of the availability and that the metabolizable energy of the ration used was 52.94 % available, or net.

Using the data given by ARMSBY (*loc. cit.*) the author has calculated that 54.995 % of the metabolizable energy was available, which agrees very closely with ARMSBY's figure (55 %).

442—**The Feeding of Young Chicks on Grain Mixtures of High and Low Lysine Content** (1). — BUCKNER, G. D., NOLLAU, E. H. and KASTLE, J. H., in *Kentucky Agricultural Experiment Station, Bulletin* No. 197, pp. 21, Tables IV, 16 Photographs.

It has been shown by OSBORNE and MENDEL in an exhaustive series of experiments on the feeding of albino rats, that lysine is primarily responsible for the stimulation of growth. The authors undertook a series of experiments regarding this subject on feeding young chicks using grain mixtures containing a low and high lysine content respectively.

EXPERIMENT I. — Two lots of young chicks of mixed breed were chosen. At the beginning of the experiment the weight in Lot I (10 chicks) was 438 gm., or an average of 43.8 gm. per chick, and in Lot II (9 chicks) 338 gm. or an average of 43.1 gm. per chick. The experiment lasted 8 weeks (May 13 to July 6, 1915) and the two lots were fed as follows:

Lot I. — received a mash twice a day, morning and evening, consisting of equal parts by weight of finely ground wheat, wheat bran, sunflower seed and hemp seed, moistened with skim milk; and once a day at noon they were given a coarsely ground mixture of wheat, hemp seed and cracked maize.

Lot II. — received 30 gm. of a mash consisting of finely ground barley, rice, hominy and oats, 100 gm. each and 56 gm. of gluten flour, the mash being made with protein-free milk; at noon they received from 30 to 50 gm of a mixture of equal parts of barley, rice and hominy.

On hydrolysis, these various rations gave (by the VAN SLYKE method) the following figures for the lysine content: —

Lot I		Lot II	
Mash	Grain mixture	Mash	Grain mixture
3.80 %	2.23 %	0.50 %	0.79 %

RESULTS. — The chickens were weighed regularly every 6 days. At the end of the experiment 5 average chickens of Lot I weighed 2 553 gm.,

(1) See R., February 1918, No. 186 (Ed.).

while 7 in Lot II weighed 1 195 gm. The average increase in weight was thus 98 gm. for Lot I and only 15.6 gm. for Lot II. This striking difference is shown clearly by photographs, which also show the state of development and feathering. Further, the chickens of Lot I were much more active than those of Lot II.

At the end of the experiment (July 6), the chickens of Lot II were put on the rations fed to Lot I. On July 13, the chickens of Lot II gained in weight 344 gm. or an increase in 7 days of 41.2 gm. per chick (the previous average, before exchange of the rations, was 15.9 gm.).

These results show that while the chickens of Lot I grew normally, those of Lot II were stunted in their growth. This difference in nutrition is probably due to the difference in the amount of lysine received by the 2 lots and possibly to a difference in the quantity and nature of the fats in the rations. The content in fats was as follows: —

Lot I		Lot II	
Mash	Grain mixture	Mash	Grain mixture
13.08 %	8.21 %	1.8 %	1.0 %

It should be remembered that OSBORNE and MENDEL, and other investigators have shown that certain of the natural fats contain substances which stimulate animal growth (1). Such fats are found in butter, cod liver oil, yolk of egg, etc.; many grains and vegetable products probably also contain growth-promoting fats. For this reason it is not safe to explain the better growth of Lot I by the better quality of the protein in the food. It thus remains to be determined whether the difference is due to differences in the protein or fats, one or both. To throw light on this question, the following experiment was carried out.

EXPERIMENT II. — Two lots of 48 White Leghorn chicks, Lots III and IV, were given the same rations as Lots I and II, save that to the ration given to Lot IV there was added sufficient butter fat to bring up the fat content up to that of the ration fed to Lot III (the old Lot I). The total weight of Lot III (12 chicks) was 488 gm., or an average of 40.6 gm. per chick. Lot IV weighed 471 gm., or an average of 39.25 gm. per chick. After 8 weeks, each chick of Lot III weighed on an average 395.6 gm., while in Lot IV, each chick weighed an average of 118 gm. Thus Lot III showed an average gain per chick of 277.6 gm. over the chicks of Lot IV. Differences in development, health, plumage, etc., were again clearly marked, and although the chicks of Lot IV were quite healthy, their growth was obviously stunted.

At the end of the second experiment the rations were again reversed, with striking results: after 3 weeks, Lot III made a percentage gain of

(1) See R., February 1918, No. 182 (Ed.).

5.1 as against 28.9 for Lot IV. Within one week after reversing the rations, the external sexual characteristics of the chicks of Lot IV became noticeable and after the third week were very pronounced.

CONCLUSION. — It is evident that the marked differences shown by the two lots in rate of growth cannot be ascribed to the fat content of the 2 rations, but rather to differences in the amino-acid content of the rations, and particularly to differences in the lysine content.

The writers emphasise the value of feeding experiments with the chicken both from a practical and a scientific standpoint. The financial returns from a sound method of feeding chickens would be enormous. From a purely scientific standpoint the young chicken is very suitable for feeding experiments as it reaches maturity in so short a time.

443 - **The Relative Value of Certain Proteins and Protein Concentrates as Supplements to Maize Gluten.** — OSBORNE, T. B. and MENDEL, L. B. with the Cooperation of FERRY, F. L. and WAKEMAN, A. J. (Laboratory of the Connecticut Agricultural Experiment Station and the Sheffield Laboratory of Physiological Chemistry in Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 1, pp. 69-92, 8 Tables, 1 Chart. Baltimore, February, 1917.

The writers undertook to measure the comparative nutritive potencies of different proteins or protein concentrates. The experiments were made with rats. With inadequate maize gluten as the basis of the nitrogenous part of the ration, the following substances were added to the diet: — casein; lactalbumin; edestin (prepared by extracting ground hemp seed with sodium chloride, repeated solution and precipitation by dilution and cooling); cottonseed protein; cottonseed flour (43.7 % protein); milkalbumin (a commercial product containing 54.2 % protein and 23.8 % of ash); beef tissue (made by drying the residue left after thoroughly extracting fresh chopped beef with water); fish meat meal (herrings, 60.5 % protein); maize germ cake (17.5 % protein); vegetable albumin flour (a commercial product, with 74.7 % protein, presumably consisting of the residues from the manufacture of wheat starch); brewers' grains (45 % protein); distillers' grains (29.4 % protein); pea meal (26.5 % protein); peanut meal (after extraction of oil; 29.4 % protein). It was found that these food mixtures, of approximately the same nitrogen and calorific content, vary greatly in their efficiency for promoting growth, in accordance with both the character and the proportion of the protein supplement employed. The efficiency of these supplements presumably depends essentially on their relative content in lysine and tryptophane; for the addition of these amino-acids, either as such, or in the form of proteins yielding them, renders maize gluten suitable for growth.

Of the various proteins employed to supplement the inefficient maize gluten, lactalbumin is by far the most effective. Satisfactory growth is obtained with smaller quantities of this protein than of any of the others recorded. The brewers' grains, distillers' grains, and "vegetable albumin flour" were the least efficient supplements used, presumably because of their low lysine content.

It is evident that the small additions of the more efficient proteins ac-

tually *supplement* the maize gluten instead of themselves furnishing all the protein used for growth, because equivalent amounts of these proteins alone in a similar ration are incapable of inducing a comparable degree of growth.

Small amounts of a superior protein are often quite as efficient for growth as larger amounts of a less adequate protein.

444 - **The Nutritive Properties of Kafirin.** — HOGAN, A. G. (Department of Chemistry, Kansas State Agricultural Experiment Station, Manhattan), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 1, pp. 151-159, 4 Charts. Baltimore, January, 1918.

JOHNS and BREWSTER (1) have shown that most of the nitrogenous part of kafir (the north American variety of sorghum), about 67 per cent. of the total protein, is soluble in alcohol, and they called this particular protein "kafirin". This protein contains 55.19 % of carbon, 7.36 % of hydrogen, 16.44 % of nitrogen, 0.60 % of sulphur and 20.41 % of oxygen. It contains the following diamino-acids:— arginine, 1.58 %; lysine, 0.90 %; histidine, 1.00 %; and tryptophane, present.

Because kafirin forms such a large proportion of the protein of kafir, and because of its increased economic importance for growth in regions of light and insufficient rainfall, its nutritive properties were studied in detail.

A basal ration was prepared containing protein, protein-free milk, butter, starch, agar, and in which kafirin formed practically the only source of protein. This diet was given to rats and always resulted in nutritive failure. Accordingly kafirin was supplemented with other deficient proteins, gliadin (10 % of the basal ration) and gelatine (10 % of the basal ration) or both proteins together (5 % of each). The addition of gliadin, for a short time at least, barely sufficed to maintain the live weight of the animals; but the addition of gelatine enabled them to grow slowly, while the two proteins together produced more rapid growth than gelatine alone. It thus seems that there are at least two limiting factors in gliadin as a source of protein; gelatine supplies one (lysine) and gliadin the other (cystine).

In further experiments the following amino-acids were added to the basal ration: — tyrosine, cystine, tryptophane and lysine, either separately or mixed individually with lysine. It was found that the addition of tryptophane and tyrosine did not increase the rate of growth of the rats; on the contrary, however, the addition of lysine plus cystine produced marked increase of growth. The author concludes that the limiting factors in kafirin are lysine and cystine. In addition, the data obtained show that lysine is indispensable for the maintenance of young animals. OSBORNE and MENDEL (1914) were of the opinion that lysine is necessary for growth but not for maintenance, because rats receiving gliadin as the sole source of protein in their ration maintained their live weight unchanged, but failed to grow, and because it was then thought that gliadine contained no lysine. The method of VAN SLYKE showed that gliadin contained an average of 1.33 % of lysine. Kafirin contains 0.90 % of lysine, but it seems that lysine is completely wanting in zein.

(1) See R., February 1917, No. 126. (Ed.)

## CATTLE

445 - The Influence of the Stage of Gestation on the Composition and Properties of Milk. — PALMER, L. S. and ECKLES, C. H., in the *Journal of Dairy Science*, Vol. I, No. 3, pp. 185-198. Baltimore, September, 1917.

The question of the influence which is exerted by gestation on the composition of cows' milk has received practically no attention from an experimental point of view. This paper presents data bearing on this question consisting in complete analyses of the milk and milk fat throughout the entire lactation period of ten cows which became pregnant at various stages of their lactation period, of one cow which was farrow and the complete analyses of the milk for three of the ten cows throughout a subsequent lactation when they were kept farrow.

It is well known that the percentage composition of cows' milk and the constitution of the milk fat, as shown by physical and chemical constants, undergo certain definite changes as the stage of lactation progresses. These changes are usually particularly marked at the close of lactation. Since under normal conditions, nearly all cows are bred at some stage of their lactation period, it is difficult to determine how much the fact of pregnancy or the stage of gestation contribute to these changes in the composition of the milk and milk fat.

The completeness of the data for the lactation periods of the experimental animals has made it possible to compare the composition of the milk and the milk fat at any stage of lactation with the average composition for the entire period. Inasmuch as the date of breeding of the animals occurred at different stages of lactation for each of the animals it has been possible to ascertain at what stage of lactation the composition of the milk and milk fat for each animal showed permanent changes from the average, and to note, at the same time, at what stage of gestation these changes took place. It seemed probable that there should be some uniformity among the different animals with regard to the stage of duration of the factor contributing the strongest influence upon the composition of the milk. Tabulation of the results from this standpoint revealed the fact, that permanent changes from the average composition of the fat occurred several weeks sooner, on the average, than similar changes in the percentage composition of the milk.

An examination of the data on the average composition of the milk for the entire lactation period in comparison with the composition of the seven-day composite which showed the first permanent change from the average, and the stages of lactation and gestation when this change occurred, shows a close relation existing between a change in the percentage composition of the milk and the stage of the lactation period, particularly with respect to the relative stage of lactation.

The data fail to reveal, however, that the changes in the composition of the milk bore any constant relation to the stage of gestation. Similar results are obtained on examination of similar data for the physical and chemical constants of the milk fat. Although the relations between the changes in the constitution of the milk fat and the stage of lactation is much less constant, the same result holds true with respect to the relation to the stage of

gestation. It would appear that some other factor may have been partly responsible for the changes in the composition of the milk fat.

Still more substantial evidence in regard to the influence of the stage of gestation on the composition of milk is furnished by a comparison of the composition on corresponding days of two lactation periods of the same cow, during one period of which she is pregnant and the other farrow.

An examination of the data available for three of the cows shows that the same shrinkage in milk flow and the same changes in the composition of the milk occurred at the end of the farrow lactation as took place at the end of the pregnant lactation, but at a somewhat later stage.

The conclusion drawn from the data presented in this paper is that gestation does not exert any direct effect upon the composition and properties of cows' milk, but that gestation may affect the composition indirectly by hastening the close of lactation, which is the important factor involved in the changes in the composition of milk as lactation advances. The characteristics of the milk as the end of the lactation approaches are high concentration of protein and fat, and frequently a lower concentration of lactose. The fat of cows' milk is characterized by great depression of the saponification value and Reichert-Meissl number, and great increase in iodine value and melting point. In addition, data which have not yet been published are presented on the influence which gestation exerts upon the composition of human milk, indicating that under normal conditions gestation exerts no influence on the composition of mother's milk and that the marked decrease in the percentage of all the solid constituents of the milk reported by another investigator as accompanying gestation in the case of human milk was not confirmed.

446 — **The Effect of Pepsin Whey on Calves.** — MCINNIS, I. T., in *The Agricultural Gazette of New South Wales*, Vol. XXVIII, Pt. 12, p. 850. Sydney, December 3, 1917.

Since pepsin has been used instead of rennet in the cheese factories of New South Wales, a breeder who had lost calves attributed their death to the use of pepsin whey as a food. For this reason the Department of Agriculture undertook an investigation to see whether there was any ground for this hypothesis. It was found that pepsin whey obtained from various cheese factories is often fed to calves without any ill effects, and is completely satisfactory in all respects, provided it is heated to at least 160° F. before use.

447 — **Swine Management in U. S. A.** — ROMMEL, G. M. and ASHBROOK, F. G., in *Farmers' Bulletin* 874, U. S. Department of Agriculture, pp. 1-38. Washington, D. C., September, 1917.

This bulletin deals with the various phases of swine production from a practical point of view, namely: feeding, breeding and management.

Some interesting data concerning weights of pigs at given ages are here reproduced.

Table I shows statistics based on information obtained from 12 practical breeders, asked to state the weights of their own pigs at given ages, and at the same time to name the weights which they considered pigs ought

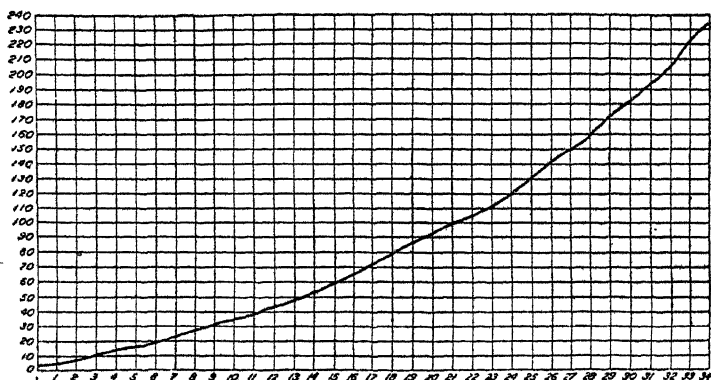
to weigh at these ages; the aim being to establish a weight standard for swine raisers to work up to. The same table also shows the average weights of 121 pigs bred and fattened at the Bureau of Animal Industry Experimental Farm at Beltsville, Maryland: The latter weights are shown more in detail in figure 1, and it will be observed that they terminate at 8 months, when the animals were marketed.

TABLE I. — *Comparison of pig weights at various ages.*

Class	Average weights (in lbs) at			
	3 months	6 months	9 months	12 months
Breeders' pigs . . . . .	41	120	191	267
Experimental Farm pigs . . . . .	48	140	235 <sup>(1)</sup>	—
Breeders' standard . . . . .	63	176	263	347

(1) Weight at 8 months, when marketed.

FIGURE I. — *Average weekly weights of 121 hogs at Bureau of Animal Industry Experimental Farm, Beltsville, Md.*



The abscissae represent the number of weeks (1 to 34) since birth (0).

The ordinates represent the live weights in lb.

#### POULTRY

448 - **Blood Fat in Domestic Fowls in Relation to Egg Production.** — WARNER, D. E. and EDMOND, H. D., in the *Journal of Biological Chemistry*, Vol. XXXI, No. 2, pp. 281-294, 10 Tables. Baltimore, August, 1917.

The work described was carried out at the Poultry and Chemical Laboratories of the Storrs Agricultural Experiment Station, Connecticut.

The natural colour of the body fat of most hens and the fat in egg yolk is yellow. This colour is due to a pigment of the xanthophyll group together with very little of a pigment isolated in crystalline form by WILLSTÄTTER and ESCHER and proved by PALMER to be identical with plant xanthophyll.



The disappearance of this colour from the external parts of the hen's body led the authors to undertake this investigation. There is in the hen a correlation between egg laying activity and yellow pigment. BLAKESLEE and WARNER have shown that when the yellow in the ear-lobes did not exceed 20 % in a given group of hens the percentage of birds laying was high; the second percentage decreased as the first increased. They concluded that "the laying removed the yellow pigment from the body for the production of eggs more rapidly than it could be replaced by the normal metabolism". This led the authors to believe that; if the yellow pigment present in the hen's body before laying is transferred to the egg yolk, the body fat containing the yellow pigment would, in a like manner, pass in the blood from the body to the egg yolk. (It should be noted that, in this paper, by "fat" is meant the total ether extract composed chiefly of fats and cholesterol).

If this be so a hen which lays heavily should have blood much richer in fat than a hen which does not lay. The authors, therefore, studied the relationship of blood fat in fowls to:— 1) egg production; 2) the presence of food in the alimentary tract; 3) the colour of legs, etc.; 4) sex. WARNER had shown previously that the average amount of fat found in high producing and in laying hens is 1.426 %, and in low producing hens 0.886 %. The results were considered to justify further study. In October, 1916, the authors commenced their work with 12 cockerels and 82 White Leghorn hens. The hens had just completed their 1st or 3rd year of laying, and among them were birds with high, medium, and low records.

The egg producing records cover a period from November 1 to the following October 31. Blood samples were taken from October 28 to November 3, 1916. The results obtained were as follows:—

There is little or no correlation between the amount of fat in the hen's blood and its annual egg yield, but the blood of a hen laying at the time the sample is taken is much richer in fat than that of a hen which is not laying.

The average percentage of fat in the 70 hens which had just completed their first year of laying was 0.407; for the twelve 1½ year old cockerels it was 0.176. These data show that it is improbable that high producing hens can be selected merely by sampling their blood and determining its fat content unless account is taken of whether or not the hen is laying at the time of sampling, and also of the season. A 16 hour fast did not seem to decrease the fat content of the blood of fowls.

There is a close relation between the colour of the beak, legs, and vent and the percentage of fat in the blood. The birds with pale legs, beaks and ani, had a high percentage of fat in their blood and a high average egg production, and vice versa. This shows that birds which are not laying store fat in the body cells and, consequently, their beaks, legs, and ani become yellow, the natural colour for all American breeds and Leghorns.

The average percentage of fat in the blood of the 3 year old hens was much lower than that of the 1 year old birds. The percentage of fat in the blood of the male birds was more constant than that of the 1 year old hens. There seems little difference between the percentage of fat in the blood of male birds and in that of hens which are not laying.

The principal reason why the blood of laying hens is much richer in fat than those which are not laying seems to be that the fat stored in the body tissues is taken up by the blood and carried to the egg yolk.

## SERICULTURE

449 - Second Report on the Experiments carried out at Pusa to Improve the Mulberry Silk Industry (1). — DE, M. N. (Sericultural Assistant, Research Institute, Pusa), in *Agricultural Research Institute, Pusa, Bulletin* No. 74, pp. 27. Tables 12. Calcutta, 1917

CROSSING. — Multivoltine races were crossed with univoltine races to see whether a multivoltine hybrid race which will yield better cocoons than pure multivoltine races, can be established. Some success was attained; multivoltine crosses thus obtained gave better yields than the pure multivoltine races usually reared in Bengal, Assam and Mysore. It seems that it will not be possible to get all the layings multivoltine from a hybrid race; a few eggs from each laying turn univoltine but they should be destroyed. The loss of these eggs can be ignored considering the advantages gained.

It was found that, in the case of a hybrid race, if all the yellow cocoons were eliminated from each generation, it is easy to get all white cocoons; but it is difficult to get all yellow cocoons after many generations if white ones are eliminated.

The following crosses were made: — (Nistari × French) × Mysore; Nistari × (Japanese-Italian); Assam × Nistari; Assam × Chotopolu; Nistari × Chotopolu; etc.

USE OF STIMULANTS. — M. Kawahito, the Director of Aichikew Sericulture Experimental Station, Japan, has been reported to get an improvement in the cocoons of univoltine races by immersing the eggs in dilute hydrochloric acid. A similar experiment was carried out by the author with a multivoltine race, but better eggs were not obtained by treatment with dilute hydrochloric acid.

EFFECT OF FEEDING. — The yield of silk can be increased by increasing the number of feedings, but the advantage obtained is not proportionate to the extra trouble and cost required for the purpose. An experiment was undertaken to find out which variety of mulberry gives the most satisfactory result in the yield and other qualities of silk and the percentage of disease in the mother moths. The best varieties were found to be *Morus alba* var. *japonica* and *M. alba* var. *philippensis* (both for univoltine and multivoltine races) and then *M. indica*. The leaves of the variety *italica* are very big and hard and not suitable for feeding the larvae. The Bengal bush variety would probably give better results if it were allowed to grow into a big tree. All races yield more silk if fed with suitable mulberry tree leaves than when fed with bush leaves. Tree mulberry should be introduced in addition to bush.

RESISTANCE TO DISEASE. — a) *Pebrine*: In a previous report the author has shown that, in a climate like that of Pusa, univoltine races are more susceptible to pebrine than multivoltine ones. The disease appears

(1) For the summary of the first report, see B. 1915, No 1071 (Ed).



more in May to October than in September to April. The more pebrinized layings are reared with healthy layings the less the number of cocoons are obtained from a rearing. The percentage of diseased moths is more or less in proportion to the pebrinized layings reared with healthy layings. Good crops and healthy layings can be obtained from a pebrinized laying if the worms are carefully attended to and if the temperature and moisture-content of the air are suitable for the healthy growth of the larvae. Bad crops and pebrinized layings are obtained from a healthy laying if the temperature and moisture-content are high and if the worms are not properly looked after.

b) *Flacherie*. — Many moths are attacked with flacherie during the rainy season when the temperature and moisture-content are high. It was found that eggs laid by moths attacked by flacherie, can be safely kept for industrial purposes though in some cases the cocoons are a little inferior to those obtained from eggs laid by healthy moths.

HIBERNATION. — Univoltine eggs should be hibernated for about 4 or 5 months at about 35° to 45° F. The author undertook an experiment to find out whether it is possible to shorten the duration of cold storage by increasing the intensity of cold and to study the effect of intensive cold on the embryos. The results showed that the duration of cold storage can be shortened by the action of intense cold, but that the eggs hatch quite unsatisfactorily.

As regards the indigenous races the author indicates the Mysore race as being the best for yield of silk. The Nistari race should be reared in April or May, the Mysore race and hybrid races from July to October and univoltine races from October to March. Of all the univoltine races, Chinese and Japanese races thrive best in a climate like that of Pusa but their yield of silk is inferior to those of France and Italy. The cross-breds between Boropolu and foreign univoltine races should be reared in those places where imported foreign races do not thrive well.

450 - **Fresh-Water Mussels: Their Exploitation and Artificial Propagation in the Rivers of the United States.** — RAVERET-WATTEL, R., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXIV, No. 11, pp. 427-438, 6 Fig. Paris, November, 1917.

OTHER LIVE  
STOCK

In the inland waters of America, there are hundreds of species of fresh water mussels (family Unionidae) many of which produce pearls much used in jewelry; for this reason, they are considerably exploited in the United States. The shells are used for making mother-of-pearl buttons. The species most in demand are *Quadrula ebena*, *Lampilis anodontoides*, *L. rectus*, *L. fallaciosus*, *L. ligamentinus*, *Tringonia verrucosa*, *Plagiola securis* and *Symphynota complanata*.

For various reasons, especially over-fishing, the mussels have been greatly reduced in numbers, so much so that various measures have been proposed to remedy such a state of affairs. As these measures do not appear to suffice, the breeding of fresh water mussels is being considered.

As these molluscs pass the greater part of their larval live on fish (par-

ticularly on the gills), the latter will be of great importance in rearing the mussels.

Researches are in progress concerning the food and other needs of the fresh-water mussels, when, having left their hosts, they begin to assume adult characters.

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

451 - **The Encouragement of Mechanical Cultivation in France.** — *Feuille d'Informations du Ministère de l'Agriculture*, Year XXII, No. 52, pp. 1-2. Paris, October 16, 1917.

The French Minister of Agriculture has published an order dated October 8, 1917, containing the following provisions: —

Agricultural groupings of at least 7 members, departments, boroughs, may receive State grants for the purchase of machines for mechanical cultivation, provided that they undertake to use the machines themselves and to prepare for and sow cereals with a minimum per machine of an acreage to be fixed in each case, according to the capacity of the machine and the nature of the soil. When the machines acquired by the above-mentioned groups consist of a set of at least 5 tractors and material for steam or electric ploughing, the subvention (acquisition of material and advances for the cost of cultivation) may amount to 50 % of the cost of the machines. In the contrary case, the subvention may not exceed  $\frac{1}{4}$  or  $\frac{1}{3}$  of the cost of the machines, according to whether the applicant will have recourse or not to an agricultural credit bank. In regions that have suffered through the war, the maxima may be raised respectively to  $\frac{1}{3}$  or  $\frac{1}{2}$  of the price of the machines.

Applications for subventions must be made to the Minister of agriculture through the prefect of the department. They will be accompanied with the opinion of the prefect and the following information obtained or verified by the director of agriculture: — the type and price of machine; the rules relating to the conditions under which the machine is to be used; a provisional estimate for the undertaking; a report on the geological, topographical and agrogeological conditions of the region where the machine is to work; the area to be worked; the engagement provided for; the rules of the syndicate for the agricultural associations, with the number of members and the funds available indicated, the bases of the division of common expenses and charges between them; the extract of the resolution of the general or municipal council for the departments and boroughs; and, finally, proof that the applicants have suffered from the invasion.

452 - **Mechanical Cultivation Tests at Rabat, Morocco, in 1917.** — *DESSAUBAT, R.*, in the *Journal d'Agriculture pratique*, Year LXXXII, No. 3, p. 53. Paris, February 7, 1918.

The Automobile Club of Morocco has carried out tests of mechanical cultivators at Oulja de Rabat from September 26 to 29, 1917. Five machines took part, the trials being carried out on compact soils greatly hardened by drought.

The results of these trials are given in the appended table.

Machines	H. P.	Depth of work, inches	Area ploughed per hour  sq. feet	Fuel used per acre	
				Paraffin gallons	Petrol gallons
Amanco . . . .	24	6—7	28 192	2 59	0 22
Bull . . . . .	20	6—7	23 336	2.96	1 52
Ford . . . . .	14	breaking-up stubble	—	—	3.22
Titan . . . . .	20	5—7	23 562	3.12	0 13
Moline . . . . .	12	breaking-up stubble	—	—	3 18

Notes are given below as regard the ploughs, the quality of work, the best average speed in relation to the area worked per hour and the width of work.

AMANCO: 4-furrow, automatic-lifting plough; width of work, 40 in.; very even work; average working speed, 8286 ft. per hour.

BULL: 3-furrow, automatic-lifting plough, width of work, 40 in.; good work; average working speed, 6775 ft. per hour.

FORD: 2-furrow plough, not self-lifting; width of work, 27 in.; breaks up stubble fairly well. The area worked per hour and the average speed were not determined. The FORD machine consists of the ordinary frame with a 14 HP. motor converted into a tractor.

TITAN: 3-furrow, automatic-lifting plough, width of work, 35 in.; very good work; average working speed, 7992 ft. per hour.

MOLINE: 2-furrow plough; width of work, 27 in. The area worked per hour and the average speed were not determined; the fuel-consumption indicated in the table is approximate.

The area ploughed per hour and the fuel-consumption per acre agree very well with the results obtained with the same machines in the trial at Noisy-le-Grand, France, in 1917 (1).

453 - **The Application of Electricity to Agriculture in France.** — DABAT, in *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. III, No. 41, pp. 1138-1155. Paris, December 26, 1918.

The author considers the present importance of the various uses to which electricity may be put in agriculture, and suggests ways of developing the extended use of electricity on farms.

Manual labour, now of increasing scarcity, should be partly replaced by machinery. Great progress has been made by using internal combustion, gas and steam engines. Electricity, though already used in agriculture, is not employed as much as it ought. Electric motors have many advantages over internal combustion engines, which are much more generally used in

(1) See R., November 1917, No. 1051 and R. January 1918, No. 81. (Ed)

agriculture and they are cheaper. However, for mechanical ploughing the electric motor is superior to the steam engine. But in spite of its qualities, the electric motor may be less economical. If certain uses of energy could support the present sale prices, for many others (motorculture, threshing cereals) the price of 15 to 20 centimes the kw-hour should not be passed. For irrigation and drainage works, the tariff would have to be lower, according to the lift required. To lower the sale price, the height of which results from the small and discontinuous demand for farm use, farmers should unite in groups comprising enough members to represent current and number of working hours of importance. On the other hand, the State should intervene and use all possible means to obtain low tariffs for farmers. The energy being supplied at rates suiting the farmers, they should remove the obstacles formed by certain methods of farming so as to derive the greatest benefit from the use of electricity.

The foundation of hydroelectric works constitutes one of the most important factors in lowering the cost of electric energy. France has, in its watercourses, an enormous quantity of latent energy, estimated statistically at from 4 to 5 million HP. at low water and 9 to 10 million at an average level; while the total nominal HP. of steam engines in France amounts to 15 million HP. It follows that the coal beds decrease every year while the water-power remains unchanged.

The adaption of watercourses for the production of electricity only dates back some twenty years. Before the war the total water power in use amounted to 620 000 HP., of which 380 000 HP. were distributed, the rest being utilised on the spot. Since 1914, the total water power, employed or about to be employed, has increased by 400 000 HP.

The author quotes various technical, administrative or legislative measures taken by the Minister of Agriculture to develop the utilisation of "white coal".

From the technical point of view, the work of the "Services des Grandes Forces hydrauliques", often praised by both French and foreign scientists and engineers, will eliminate the necessity for private individuals of long and costly study regarding the exploitation of watercourses.

Regarding administration and legislation, the Minister of Agriculture has drawn up rules for Communes when about to transfer their water rights and he has put forward several bills attempting to remove the hindrance caused by the present legislation to the industrial use of watercourses. To obtain reduced tariffs for agricultural work, he has obtained that the principle of reduced tariffs in favour of syndicates should be inserted in the contracts. The obligation of furnishing current at low prices is also provided for in various concessions for works on rivers of the public land conceded by the Minister of Public Works. The text of a recent bill regarding *all the categories of watercourses* not only gives concessions to syndicates, but also to *agricultural groupings of any kind*. The bill contains clauses requiring industrial concession-holders to provide reserves of water and current for agriculture and accords reduced tariffs to all agricultural groupings of general interest.

The Minister of Agriculture also helps to organise coöperative societies for the generation and distribution of energy. The State, in this case, has helped financially as well as providing for the collaboration of the technical experts of the Service for agricultural improvements. The Minister has also profited from the establishment of works founded since the war to intensify the production of chemical fertilisers. To this end, some contracts require that, for a certain period of years after peace has been declared, considerable amounts of energy shall be provided for the manufacture of calcium carbide and cyanamide.

For some years, the electrical distribution societies have completely neglected to obtain the custom of farmers. But they have finally realised that if, when commercing work, they were justified in seeking more paying customers (lighting, transport, industry), it would have been better management to seek other outlets, such as agriculture, which, by means of lowered tariffs, would consume that surplus energy which is often too difficult to utilise. Accordingly the distributors have decided to do propaganda work to interest farmers in the uses of electricity in agriculture. The electrical exhibition at Marseilles (1908), the international electrocultural congress at Rheims (1912), the general agricultural competition of 1913, have greatly contributed to a more widely diffused knowledge of the application of electricity to agriculture. Some distributing societies addressed the farmers directly. For example, the Motive Power Society of Refrain, at Montbéliard, should be mentioned, as it has installed electricity in several agricultural villages, under the stipulation that if the consumers were not satisfied, the current would be withdrawn and no charges made. In every case the installation has been retained.

The author thinks that the State should encourage these societies to continue in this way, by helping to form agricultural associations for using energy in common. In this way, not only would the total energy required by farmers increase, but the hours of current consumption would be greater owing to circulation established between the associations. Whilst distributing energy among the consumers to as to reduce variations of load while increasing its duration, thus playing a similar part to the syndical associations for the distribution of irrigation water, the association would reduce the concession-holders' expenses and assist development. If new lines have to be installed to supply the agricultural consumers, the association will help to equalise the charge on the capital invested by dividing it among a large number of consumers. The association has also the advantage of buying the more expensive apparatus to be used in turn by the members.

The author shows that the State rather than distribution societies should found these associations. The distributors might hesitate on account of the time and capital required and become discouraged by the set-backs always produced by attempts to unite agriculturists. The State has more powerful means of action and it should intervene all the more, seeing that these collective organs would not only be useful for furnishing energy, but would enable all sorts of agricultural improvements to be carried out: threshing in common, co-operative dairies, distilleries, etc.

The author also points out the value of State help in showing the most economic and suitable method of utilising energy, so that all possible facilities may be obtained from the distributors and full profit from the advantages given them by law. In the case where the supplying of farms would require the extension of a distribution network, and the cost would fall on the consumers, the project might be formulated by the technical experts of the Service for agricultural improvements, who would supervise the work, while the cost would be lightened by subventions and loans from State funds. This technical and financial aid would always be given to farmers whenever the utility of forming a special service for production and distribution is recognised.

It is to be hoped that the co-operative movement, first intended for the common working of farm products, with oil works, cooperative wine-cellar, and continued by the common purchase and use of threshing machines, will extend to the generation and distribution of electric energy. Thanks to the various measures now under discussion, which will be supplemented by active propaganda, the agricultural use of electricity will be rapidly developed, to the great profit of French agriculture.

454 - **Tractors in the United States.** — I. Extract from the *American Thresherman* published in the U. S. Department of Agriculture Experiment Station Record, Vol. XXXVII, No. 4, pp. 387-288, Table. Washington, September, 1917. — II. RINGELMANN, MAX, in the *Journal d'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 2, p. 30. Paris, January 24, 1918.

I. — Tabulated data concerning the operations of 50 large tractors and 37 small tractors during 1916-17. Fifteen of the large tractors used gasoline and 44 used either kerosene or distillate.

The relation of horsepower to work is shown in the following table:—

Rating of tractors HP.	Area ploughed in 10 hours, acres.	Rating of tractors. HP.	Area ploughed in 10 hours, acres.
5-12	6.30	15-30	11.80
8-16	6.60	25-45	19.20
10-20	7.70	30-60	21.00
12-25	9.00	40-60	25.75

II. — M. RINGELMANN observes that the figures apply to lighter soils than those in France, with more shallow ploughing, and a longer furrow-length. So, to obtain figures applicable to France, M. RINGELMANN multiplies the figures given above by 0.7.

According to the report, 72 holders out of 96 stated that the work done by tractor costs less than that done by horses. On the other hand, 40 holders having tractors of over 30 HP. were in favour of mechanical traction, while two years ago there were only 30 in favour. Amongst 27 holders having tractors of less than 30 HP., 33 declared in favour in the previous year, while in the present report only 30 were favourable to mechanical cultivation.



455 - **The Conversion of Motocars into Tractors** (1). — I. The "Shofield" Auxiliary Wagon. *Le Genie Rural*, Year X, No. 78, pp. 8-9, 3 Fig. Paris, 1918. — II. The "Tracford" Conversion Unit. *The Implement and Machinery Review*, Vol. XXXXIII, No 513, p. 958, 1 Fig. London, January 1, 1918.

I. — The SHOFIELD Co. of Kansas City, U. S. A., have a useful device which enables a motorcar to be used as a tractor with only slight change. The device consists of an auxiliary wagon which is towed on the road by the motor car, while the latter is mounted on the wagon in the field.

When on the wagon, the car is held firmly on a two U shaped rails in which the automobile wheels engage. The back wheels of the wagon, serving as driving wheels, have each a rim with internal teeth which engage with a gear whose axle turns on a bearing fixed on the wagon; this axle carries a sprocket wheel. Another sprocket wheel is mounted on the hub of each rear wheel of the car. The two sprockets are connected by a chain. The rear of the car is lifted until the 2 chain drives are sufficiently taut; then the driving wheels of the car turn freely, the movement being transmitted to the rear wheels of the wagon. The front wheels of the wagon can be steered by a wheel placed by that of the car, but which turns vertically. According to the inventor, mounting requires about 10 minutes.

II. — Another conversion unit to enable a FORD car to be used as a tractor, is the "Tracford", sold at £ 65 by the POWER FARM SUPPLY Co., Priory Lawn Chambers, Ellys Road, Coventry.

The device comprises a pair of large tractor wheels fitted with removable mud strokes, and mounted on a strong axle which is attached to the rear end of the frame of a FORD car. A pair of roller pinions replace the wheels at the end of the FORD axle and these pinions gear with a series of 8 gear sections of 7 teeth each, which are bolted to the inside of the tractor wheels.

The result is a 9 to 1 reduction in the gearing, the road speed being reduced  $\frac{1}{9}$ , while the power delivered at the axle is increased ninefold. A supplementary water tank is mounted over the engine, and a water circulator automatically provides forced circulation through the radiator. The tractor axle forms the draw bar.

The "Tracford" unit weighs less than 800 lb.; its axle is of 1. 15-16 in. solid steel and the wheels have a 10-in. face with angle-iron lugs attached.

456 - **Fuel Saving.** — STRITTMATTER, A., in the *Farm Implement News*, Vol. XXXIX, No. 1, pp. 36-38. Chicago, January 3, 1918.

While the actual production of petrol in the United States is 6 849 000 gallons per day, the Bureau of Mines estimates that 1 500 000 gallons are wasted daily through various losses, such as leaky tanks, badly-adjusted carburettors, motors running idle, waste in garages, etc. The Automobile Chamber of Commerce has suggested methods of economy which are quoted below:

1) Store petrol in underground steel tanks. Use wheeled steel tanks with measuring pump and hose. They prevent loss by fire, evaporation and spilling.

2) Don't spill or expose petrol to air — it evaporates rapidly and is dangerous.

(1) See R. June 1917, No. 577 and December 1917, No. 1204 (Ed.).

- 3) Don't use petrol for cleaning or washing — use other materials to remove grease.
- 4) Stop all leakages. Always shut off gas at tank or feed pipe.
- 5) Adjust brake bands so as not to drag. See that all bearings run freely.
- 6) Don't let engine run while car is standing. It is good for the starter battery to be used frequently.
- 7) Have carburetors adjusted by the makers or by automobile companies.
- 8) Keep needle valve clean and adjust carburetor (while engine is hot) to use as lean mixture as possible. A rich mixture is wasteful.
- 9) Preheat air entering carburetor and keep radiator covered in cold weather to ensure better vaporization.
- 10) Time spark correctly and drive with spark fully advanced — a late spark increases gas consumption.
- 11) Have a hot spark; keep plugs clean and spark points properly adjusted.
- 12) Avoid high speed. The most economical speed is 15 to 25 miles per hour.
- 13) Don't accelerate and stop quickly — it wastes gas and wears out tyres.
- 14) Avoid aimless and needless use of cars. Do a number of errands in one trip.
- 15) Find out the mileage per gallon. Fill tank full and divide odometer mileage by gallons consumed.

The author considers these rules at length: He points out that, with farm engines, carburetor adjustments are easily made while the engine is running, largely by watching the character of the exhaust and the noise it makes. Although the last three rules apply to motorcars, the last one is useful for a farmer using a tractor. He ought to know how much fuel the tractor uses in plowing a certain field or doing some piece of work, such as filling a silo.

457 - **Fire Prevention and Fire Fighting on the Farm, in U. S. A.** — TOLLEY, H. R. and YERKES, A. P., in *United States Department of Agriculture Farmers Bulletin* No. 904, pp. 16, 1 Fig., bibliography of 11 publications. Washington, D. C., January, 1918.

Organised fire prevention is still neglected in farms, as few farmers have considered the means to adopt for preventing and fighting fires. Yet millions of dollars' worth of agricultural wealth is destroyed by fire in the United States each year. At normal prices and with an average crop, the loss is about equal to the value of the potato crop in that country. This bulletin is intended to interest farmers in fire prevention on his own premises and to urge him to eliminate all unnecessary fire hazards, while providing all required facilities for fighting fires.

The writers consider the common fire hazards and point out that, as regards the spontaneous combustion of hay stacks, the first cut of alfalfa seems to be the most dangerous in that respect. In addition, precautions should be taken in buildings where incubators, brooders, evaporators, and other equipment requiring the use of fire are housed.

Farmers' Bulletin 842 of the U. S. Department of Agriculture gives directions for installing modern lighting rods. In some instances, farmers' mutual fire insurance companies make reductions on the premiums charged on rodded buildings.

As regards methods of fire fighting, water is the simplest and cheapest fire extinguisher; pails of water should always be placed in every farm building so as to be instantly available in case of need. Water-supply systems

which furnish water under pressure afford excellent facilities if the necessary hose and connection are always ready for use.

Amongst chemical extinguishers carbonic acid is that most generally used. More than 20 firms manufacture soda-acid extinguishers costing from \$7 to \$12. They are of simple construction and can throw a stream from 25 to 40 feet for about a minute. These extinguishers can be refilled and used many times.

Another type of chemical extinguisher consists of a metal syringe filled with carbon tetrachloride, a liquid that only freezes at  $-50^{\circ}\text{F.}$ , and which, at about  $200^{\circ}\text{F.}$ , turns into a heavy vapour which covers and smothers the fire. It is very useful in extinguishing burning oil, gasoline, or kerosene, on which water or carbonic-acid gas extinguishers have little effect. An extinguisher of this type costs about \$8 and liquid for refilling it can be purchased for about \$1.50; it is approved by all fire insurance companies.

In Department Bulletin 379 of the U. S. Department of Agriculture an automatic fire extinguisher (1) for use in grain separators is described which can also be used for general fire protection on the farm when the separator is not in use. Besides these types there are also dry-powder extinguishers consisting of metal tubes filled with powder, and hand-grenade extinguishers.

It should not be forgotten that sand is a very good extinguisher of burning oil; in such a fire, water is of no use, unless applied in large quantities. Sawdust mixed with soda at the rate of a bucket of sawdust to 1 or 2 lb. of soda is a good extinguisher of oil fires, especially if the oil is in a deep container.

#### 458 - Review of Patents.

##### *Tillage Machines and Implements.*

Canada	179 567 — 179 790 Cultivators.
Denmark	22 746 Turf dividing machine.
France	485 616 Cultivator.
	485 721 Rotary mouldboard.
	485 834 Vineyard plough with adjustable device for cultivating between the plants.
Switzerland	77 205 Motorplough.
United States	1 250 329 Agricultural implement.
	1 250 591 Land roller.
	1 250 962 — 1 251 068, Ploughs.
	1 251 198 Rotary harrow.
	1 251 324 Weeder.

##### *Irrigation.*

France	485 789 Overhead spraying apparatus.
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##### *Manures and Manure Distributors.*

Brazil	9 937 Apparatus for grinding bones.
United States	1 250 981 — 1 251 372. Manure spreaders.
	1 251 225 Fertilizer distributors.

(1) See R., 1916, No. 1208. (Ed.)

*Drills and Seeding Machines.*

- United States 1 250 297 — 1 250 559. Seed planters  
 1 250 298 Maize planter clutch controlling mechanism.  
 1 251 021 Maize planter.

*Various Cultural Operations.*

- United States 1 250 791 Beet chopper.

*Control of Diseases and Pests of Plants.*

- United States 1 250 516. Boll weevil exterminator.

*Reapers, Mowers and Other Harvesting Machines.*

- Canada 179 531 Stooker.  
 180 051 Lawn trimmer.  
 France 485 896. Fore-carriage for mowers, reapers and binders.  
 Switzerland 77 080 Tightening claws for sheaf bands.  
 77 206 — 77 208. Mowers.  
 United States 1 250 347 Hay rake.  
 1 250 737 Shock loading and unloading machine.  
 1 251 373 Automobile hay rake.  
 1 251 403 Corn husking machine.  
 1 251 425 Pea nut harvesting machine.

*Machines for Lifting Root Crops.*

- Denmark 22 659 Beet topping and pulling machine.  
 United States 1 250 458 — 1 251 362 Beet harvesting machine.

*Threshing Machines.*

- United States 1 251 187 Threshing machine.

*Machine and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Canada 179 671 Hay fork.  
 179 780 Sheaf collector.  
 180 080 Chariot.  
 France 485 671 Hay loader.  
 United States 1 250 334 Slacker for hay and the like.  
 1 250 337 Hay loader.  
 1 250 824 Hay elevator.

*Traction and Steering of Agricultural Machinery.*

- France 485 695 Agricultural motor.  
 United States 1 250 156 Guiding mechanism for agricultural implements.  
 1 250 381 Power transmission mechanism for traction machines.  
 1 250 964 Draft equalizer.

*Housing of Livestock.*

- Switzerland 77 081 Halter.  
 United States 1 250 358 Feed grinder.  
 1 251 374 Hog trough

*Poultry Farming*

- Canada 179 797 Brooder.

*Dairying*

- Denmark 22 657 Churn.  
 22 767 Butter handling device.  
 Switzerland 77 243 Cheese press.

*Various.*

- Denmark 22 664 Water wheel.

459 - **The Construction of Poultry Houses, in U. S. A.** — SCHOPPE, W. F., in the *Montana Agricultural College Experiment Station, Circular No. 72*, pp. 49-69, Figs. 11, Bozeman Montana, September, 1917.

The proper and comfortable housing of poultry is essential to maintain their health and vigour. Abundance of sunshine and fresh air should be provided for, and the system of ventilation should be arranged so as to remove all dampness, while constantly changing the air.

The poultry house should be so high as to allow head room for the attendant. Such low houses are less affected by outside temperatures and are more comfortable for the birds. The width of the house more or less depends upon the type of roof. For northern conditions with cold winters, the wide house is to be desired. This allows the roosts to be placed at the back and keeps the birds away from the open front. The sun shining into a wide house warms it more easily. The house should be so placed that the sun shines in at the openings every hour of the day, especially in winter. A good rule for placing windows is to allow 1 square foot of glass for every 4 birds. The author describes the different types of houses, giving all details required for the construction of a house 16 × 26 feet. The poultry house in use at the Montana Experiment Station is narrow, 12 ft. wide and with a shed roof. It has proved fairly satisfactory, but would have been better if it had been built wider. The front of each pen is provided with a door and two windows, one glazed, the other of wire netting. The wire netting can be covered with a curtain to shelter the birds against winter cold and summer heat. Each pen is made 12 × 16 ft, thus housing 50 birds. The back wall is 6 ft. and the front wall 8 ft. high. This poultry house in reality consists of a number of pens joined up in a straight line.

The details of construction of the houses, which are particularly suitable for Montana conditions, are shown in figures.

## RURAL ECONOMICS.

460 - **Cost of Keeping Farm Horses and Cost of Horse Labour in the United States.** —

COOPER, M. R., in *United States Department of Agriculture, Bulletin No. 560* (Office of Farm Management), pp. 1-24, Washington, D. C., July 9, 1917.

The cost of horse labour has a bearing on the net return of every farm enterprise, but being chiefly made up of items of expense representing materials furnished by the farm and not involving a direct cash outlay is not fully appreciated by farmers who have not made a study of the subject.

This bulletin shows how the annual cost of keeping a farm work horse and the cost per hour worked may be determined, and points out that the cost per hour worked is the true measure of the profitableness of a horse to its owner.

The data presented were obtained from cost-accounting records for 316 horses on 27 farms in three States, namely Illinois, Ohio and New York. The cost records kept on these farms consisted of detailed daily reports of

all labour and financial transactions, complete inventories and other necessary information for determining not only the costs and returns of farm work horses, but also the costs of operation and returns from the entire farm business.

A detailed summary of the annual average cost per horse, and the percentage of the total gross cost represented by each item for the horses studied in each State, will be found in Table I.

TABLE I. — *Detailed summary of average annual costs and credits per horse by States (37 farms, 316 horses).*

GROSS COSTS

Item	Illinois (154 horses)		Ohio (72 horses)		New York (90 horses)	
	\$	%	\$	%	\$	%
Feed and bedding . . . . .	68.75	65.0	76.86	58.8	91.25	57.1
Labour . . . . .	13.99	13.2	27.48	21.0	22.09	13.8
Interest . . . . .	7.90	7.4	8.66	6.6	9.43	5.9
Stabling . . . . .	4.95	4.7	7.18	5.5	12.08	8.1
Use of equipment . . . . .	3.82	3.6	5.00	3.8	5.85	3.7
Shoeing . . . . .	0.86	0.8	2.35	1.8	4.56	2.9
Depreciation . . . . .	3.46	3.3	—	—	11.56	7.2
Net loss on colts . . . . .	0.04	—	1.24	1.0	—	—
Miscellaneous . . . . .	2.12	2.0	1.90	1.5	2.09	1.3
Total . . . . .	105.89	100.0	130.67	100.0	159.81	100.0
CREDITS						
Manure . . . . .	5.24	—	8.20	—	13.36	—
Horse appreciation . . . . .	—	—	2.10	—	—	—
Colt profit . . . . .	—	—	—	—	1.43	—
Total . . . . .	5.24	—	10.30	—	14.79	—
NET COST						
Cost of keeping, less credits . . . . .	100.65	—	120.37	—	145.02	—

These gross costs and net costs represent the average cost of the work performed by the horse. It will be seen that, with few exceptions, each item of cost was greater in Ohio than in Illinois, and still greater in New York.

This variation in average cost is discussed by the writer analytically for the different items of cost and credit.

*Kinds of Feed.* — The number of kinds of feed used were 11 in Illinois, 16 in Ohio and 18 in New York. In all cases the principal feeds used were maize, oats, hay, straw and pasture, representing 97 % of the total feed cost in Illinois, 94.5 % in Ohio, and 88 % in New York.

Corn was the principal grain fed in Illinois, oats in Ohio and New York. The greatest quantity of hay per horse was fed in New York, and the most pasture per horse was used in Illinois (4.93 months, against 2.26 in Ohio and 1.13 in New York).

*Cost of Feeds.* — In Table II the feeds are divided into three classes, namely, grain, roughage and pasture by States.

TABLE II. — *Average quantity and cost of grain, roughage and pasture per horse by States (27 farms, 316 horses).*

Kind of feed		Illinois (154 horses)		Ohio (72 horses)		New York (90 horses)	
		Average quantity per horse	Average cost per horse	Average quantity per horse	Average cost per horse	Average quantity per horse	Average cost per horse
Grain . . . . .	lb. 4 500		\$44.93	3 347	\$40.71	2 691	\$38.55
Roughage . . . . .	lb. 4 224		16.13	6 660	32.65	9 513	51.20
Pasture . . . . .	days 148		7.69	68	3.50	34	1..50
			\$68.75		\$76.86		\$91.25

These costs are based on the values of feeds at the farm for feed raised, and on actual cash costs for feeds purchased. The price of corn in New York f. i. as compared with Illinois is 42 per cent. greater, and of oats 36 per cent. greater, while the price of hay is only 9 per cent. more in New York than in Illinois.

It is evident that variation in feed prices had a marked influence on the total feed cost per horse in each State.

In Table III are shown the variations in monthly feed costs on three individual farms, one from each of the three States.

TABLE III. — *Variation in feed costs, by months, on three individual farms situated in Illinois, Ohio, and New York respectively.*

Month	Illinois \$	Ohio \$	New York \$
March . . . . .	8.68	7.75	7.94
April . . . . .	7.65	7.30	7.68
May . . . . .	7.34	8.42	10.39
June . . . . .	6.66	7.30	10.68
July . . . . .	7.00	7.20	7.93
August . . . . .	4.70	6.50	7.76
September . . . . .	4.58	6.66	7.53
October . . . . .	4.32	6.29	6.23
November . . . . .	4.67	5.40	6.22
December . . . . .	4.40	5.70	6.56
January . . . . .	4.40	5.94	6.56
February . . . . .	4.23	6.42	5.92
Average . . . . .	5.72	6.74	7.62

*Labour costs.* — Labour includes the number of hours of both man and horse labour devoted to feeding and taking care of the horses, cleaning stalls, hauling feed and supplies, and to any other labour performed for the benefit of the horse. The hauling of manure from the barn and barnyards is not charged against the horses, but becomes part of the manure cost charged to the crop on which it is applied. The number of hours, cost per hour, and total cost per hours of man and horse labour devoted to the care of horses is shown in Table IV.

TABLE IV.—*Number of hours, cost per hour, and total cost per horses of man and horse labour devoted to the care of horses by States (27 farms, 316 horse).*

Kind of labour	Illinois (154 horses)			Ohio (72 horses)			New York (90 horses)		
	Hours	Cost per hour Cents	Total cost \$	Hours	Cost per hour Cents	Total cost \$	Hours	Cost per hour Cents	Total cost \$
Man labour . .	85.2	14.95	12.74	164.6	16.00	26.34	127.3	16.40	20.88
Horse labour . .	13.1	9.56	1.25	8.2	13.90	1.14	8.5	14.22	1.21
Total . . .			13.99			27.48			22.09

*Interest on value of horses.* — The average value of the horses studied in this work were as follows: Illinois, \$158; Ohio, \$173; New York, \$189.

*Stabling Cost.* — This cost, calculated on a 5 per cent. interest on the part of buildings used for stabling horses, varied from 4.7 per cent. of the total gross cost of keeping in Illinois to 8.1 per cent. in New York.

*Use of Equipment.* — In Illinois this cost calculated on a 5 per cent. interest on the average investment in harness and miscellaneous equipment used by horses, both cash and labour for repairs, insurance, taxes and depreciation, was about \$4 per head and \$1 and \$2 higher in Ohio and New York respectively.

*Shoeing.* — On many of the farms this expenditure was of minor importance, since the horses were not shod except when needed for heavy road work or when used on frozen ground. The average cost was therefore only \$0.86 in Illinois, \$2.35 in Ohio, but \$4.56 in New York.

*Depreciation and Appreciation.* — In determining depreciation and appreciation in value of horses a yearly inventory value was placed on each horse on the farm by careful appraisal and a record was kept of each horse bought and sold. Table V shows the percentage of horses that appreciated in value, the percentage that did not and the factors influencing the aggregate depreciation or appreciation by States.

TABLE V.—*Percentage of 316 horses that appreciated in value, percentage that did not appreciate, and the factors influencing the aggregate depreciation or appreciation, by States (27 farms, 316 horses).*

State and number of horses	Percentage of horses that showed		Num-ber of deaths	Num-ber bought	Num-ber sold	Num-ber of colts bought	Num-ber of colts sold	Num-ber of colts fed
	Appreciation	No appreciation						
Illinois (154 horses) . . . . .	18.75	81.25	3	21	21	2	—	43
Ohio (72 horses) . . . . .	21.95	78.05	—	9	17	2	1	7
New York (90 horses) . . . . .	4.95	95.05	6	6	3	1	2	18
The three States (316 horses) . . . . .	15.60	84.40	9	36	41	5	3	68

The average net depreciation of the 316 horses was \$4.50 per horse. Depreciation varied from \$11.60 per horse in New York, to an apprecia-



tion of \$ 2.10 per horse of Ohio. (On 378 farms studied in Chester County, Pa. the average depreciation resulting was \$ 7 per head, largely determined by the practice of farmers in disposing of horses while they are still saleable at a satisfactory price. On 14 New York farms in 1912 and 31 in 1913 the average annual depreciation was found to be \$ 14.03. Of the 35 farms studied, 12 showed an appreciation of horses. In Rice County, Minnesota, depreciation varied from \$ 0.98 in 1905 to \$ 15.48 in 1904, averaging for four years \$ 5.56 per head; in Lyon County it averaged \$ 6.94 and in Norman County \$ 5.82 per head.

*Profit and loss on colt account.* — Of the 43 colts fed on the Illinois farms 19 were born during the years of the survey and showed a loss of 4 cents per head, in Ohio \$1.24 per head, while on the New York farms the colts showed an average profit of \$ 1.43 per head. This survey proved that only under favourable conditions is the raising of colts one way of keeping down the cost of horse labour.

*Miscellaneous costs.* — Including insurance, share of taxes, veterinary services and medicine, etc., varied from \$ 1.90 on the Ohio farms to \$ 2.12 in Illinois.

*Manure.* — Horses were credited with only the manure recovered from the stables and feed lot, which was valued at \$ 1 per ton before removal. The average manure credit was greatest in the States where the horses were fed the largest quantities of grain and roughage and pastured the least number of days.

*Variations in net costs.* — Including in one group those years for which the net cost per horse was greater than the average for the State and in another group those years for which the net cost per horse was less than the average for the State, the following differences, shown in Table VI, between the group above the average cost and the group below the average cost were obtained.

TABLE VI. — *Detailed difference in costs and credits between records showing a net cost per horse above the average and below the average. (10 farms, 154 horses).*

State	Feed (cost) \$	Labour (cost) \$	Depre- ciation (cost) \$	Appre- ciation (credit) \$	Colt loss (cost) \$	Colt profit (credit) \$	All other costs \$	Manure (credit) \$
Illinois farms . .	18.05	4.24	1.96	—	3.92	3.38	2.59	0.39
Ohio farms . . .	32.11	7.59	0.07	4.50	2.86	0.34	4.78	2.19
New York farms	9.41	1.68	5.13	—	0.14	3.70	8.90	1.90

*Relation of the work performed to the total feed cost.* — In order to show the relation if any, existing, between the total work done by a horse and the total cost of feed, which is the greatest item of cost in keeping a farm work horse, the yearly records for each State were divided into two groups with reference to the average total work done per horse. The first group contains the data for those farms on which the horses worked more hours than the average for all records in that State. The second group contains data for those farms on which the hours worked per horse were less than the average for the State group. (See Table VII).

TABLE VII. — *Relation of work done to the total feed cost by States*  
(27 farms, 316 horses).

	Illinois (154 horses; average hours worked, 1053)			Ohio (72 horses; average hours worked, 867)			New York (90 horses; average hours worked, 1020)		
Records with work hours per horse	Aver- age hours worked per horse	Aver- age feed cost per horse	Aver- age feed cost per hour	Aver- age hours worked per horse	Aver- age feed cost per horse	Aver- age feed cost per hour	Aver- age hours worked per horse	Aver- age feed cost per horse	Aver- age feed cost per hour
Above the average (1) . .	1200	\$75.20	\$0.063	1055	\$89.00	\$0.084	1172	\$97.30	\$0.084
Below the average (2) . .	880	\$67.30	\$0.077	723	\$67.30	\$0.093	863	\$85.00	\$0.098
Difference . .	320	\$7.90	\$0.014	332	\$21.70	\$0.009	309	\$12.30	\$0.014

(1) Records: Illinois 8, Ohio 7, New York 9. (2) Records: Illinois 9, Ohio 9, New York 9.

This table shows that there is a relation between the work done and the quantity of feed consumed per horse, but the excess in feed cost for the harderworking horses is more than offset by the extra number of hours worked by them, so that the average feed cost per hour of labour in this group was about 1  $\frac{1}{2}$  cents less on the Illinois and New York farms and about 1 cent less on the Ohio farms.

On an average on the farms studied there was a fairly uniform difference between the average feed cost and the total cost per hour of horse labour, showing that the number of hours worked and the feed cost per horse are the controlling factors in the total cost per hour of horse labour.

*Cost of horse labour per hour.* — The cost of horse labour depends on the net cost yearly to keep a horse, and the total amount of work done (See Table VIII).

TABLE VIII. — *Cost of horse labour per hour* (27 farms, 316 horses).

State	Average hours worked			Average net cost per horse	Average cost per hour worked
	Per year	Per week day	Per Sunday		
Illinois (154 horses) . .	1053	3.30	0.10	\$100.65	\$1.0056
Ohio (72 horses) . . . .	866	2.70	0.46	\$120.37	\$0.1390
New York (90 horses) . .	1020	3.24	0.13	\$145.02	\$0.1422

*Labour performed by months.* — In each State very little labour was performed by the horses during January; February, 30 to 40 hours; about 60 hours in March. Thereafter the work increased until, during May, the maximum for any one month was reached (182 hours in Illinois, 168 in New York and 120 in Ohio). From then on to the end of the year there was a fairly uniform decrease in the hours worked per month. In New York and Illinois the increases in October and November (95 and 85 hours respectively) are due to grain threshing and maize harvest. In Illinois the greatest amount of extra horse labour was required during August, in Ohio, and October in New York. This extra horse labour was usually

exchange work among neighbours, the major part being used in grain threshing, maize harvest and autumn seeding.

Table IX shows the average number of week days when no horse labour was performed, by months.

TABLE IX. — *Average number of week days when no labour was performed, by months.*

Month	Illinois (10 farms)	Ohio (7 farms)	New York (10 farms)	Month	Illinois (10 farms)	Ohio (7 farms)	New York (10 farms)
January . .	8.3	9.7	12.4	July . . .	1.2	3.1	1.5
February . .	5.8	7.0	9.5	August . .	3.8	2.1	5.3
March . . .	7.0	6.8	12.0	September.	3.0	4.0	3.5
April . . .	2.7	4.6	4.6	October . .	3.5	5.4	4.8
May . . . .	5.0	2.2	1.3	November.	1.9	3.5	5.8
June . . . .	1.1	2.5	1.2	December .	5.1	7.6	11.3
				Total . . .	48.4	58.5	73.2

*Relation of total crop acres per farm to crop acres per horse.* — This relation is shown in Table X.

TABLE X. — *Relation of total crop acres per farm to crop acres per horse by States (27 farms, 316 horses).*

	Illinois (10 farms; average size 166 acres)		Ohio (7 farms; average size 74 acres)		New York (10 farms; average size 94 acres)	
	Average per farm	Average per horse	Average per farm	Average per horse	Average per farm	Average per horse
	Acres	Acres	Acres	Acres	Acres	Acres
Farms above the average size	230.2	22.2	93.7	17.8	112.74	20
Farms below the average size.	111.2	16.8	54.7	14.6	70.07	17
Difference . . .	119.0	5.4	39.0	3.2	42.67	3

From these figures it appears that the large farms permit of a more efficient use of horse labour than do the small farms. On the large farms in Illinois there were 22.2 acres in crops per horse while on the small farms there were but 16.8 acres per horse. Similar results were found on both the Ohio and the New York farms, though in these States the difference between the two groups was not as great as in Illinois.

## AGRICULTURAL INDUSTRIES.

461 — **New Method for the Separation and Estimation of Lactic, Succinic and Malic Acid in Wine.** — LABORDE, J., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 23, pp. 793-795. Paris, December 3, 1917.

As the methods in general use are unsatisfactory, the author describes a new one which gives good results, not only with wines poor in sugar, but also in very sweet wines.

INDUSTRIE  
DEPENDENT  
ON PLANT  
PRODUCTS

I. — UNSWEETENED WINES. — In the case of red wines the tannic substances are first removed as follows :— 50.cc. of the wine is taken, and the acidity neutralised by a volume  $V$  of normal potash equal to the total acidity. A 5 % mercuric acetate solution is then added, avoiding an excess of mercury salts, until the tannic substances are almost completely precipitated ; the mixture is heated to about 50° C. and the precipitate washed twice with warm water.

In the case of white wines this preliminary operation is necessary only if the proportion of tannin is about 1 gm. per litre; it is sufficient to neutralise the acidity of the wine with normal potash.

To the liquid thus obtained is added a volume  $S$  of normal  $H_2SO_4$  so that  $S = V = n$ ; the volume  $n$  depends on the difference in the total alkalinity of the ash  $A$  expressed as cream of tartar and the alkalinity  $T$  of the cream of tartar corresponding to the tartaric acid of the wine ; if  $T$  is greater than  $A$ ,  $n = -(T-A)$ , and if  $A$  is greater than  $T$ ,  $n = +(A-T)$ .

The solution is then concentrated in an evaporating dish until the mixture is syrupy : 5 cc. of water are added and evaporation continued to drive off the volatile acids, the dry extract made syrupy again by the addition of a few drops of water; 0.20 gm. of pure bone charcoal is added, with sufficient pure sand to divide the mass and facilitate its removal from the dish. The mixture is then poured into a conical flask, the dish rinsed with a little sand and 25 cc. of 95° alcohol, which are used to extract the free acids. To facilitate this extraction 50 gm. of No. 4 lead shot are poured into the flask which is shaken with a circular movement to divide the lumps of sand ; 50 cc. of ether are added, the flask shaken, and after it has been left standing for a few moments, the solution is poured on to a flat filter, and the deposit washed three times with a mixture of equal volumes of ether and alcohol. The filtrate contains lactic, succinic and malic acid, but no tartaric acid, which remains in the deposit as cream of tartar. The liquid is distilled until only a few cc. of yellow-brown alcohol are left, which are decolourised with 0.20 gm. of bone charcoal and 10 cc. of water, filtered, and washed with tepid water. The aqueous solution of the acids is concentrated by boiling, neutralised in the presence of phenolphthalein until the pink colour caused by an excess of 0.5 cc. alkaline liquid remains for about 15 seconds in the boiling liquid. The calcium salt solution is concentrated to 8 or 9 cc., a drop of 50 % acetic acid added, and the calcium lactate separated by adding rapidly 90 cc. of 95° tepid alcohol. In this alcoholic liquid of about 85° the calcium lactate remains in solution; whereas the malate and succinate are completely precipitated. The mixture is boiled to coagulate the precipitate, and after cooling, is filtered and washed with 85° hot alcohol. The estimation of the calcium in the filtrate gives the corresponding quantity of lactic acid.

The precipitate left on the filter is treated with boiling water, which re-dissolves it completely (except for a little calcium phosphate), it is then concentrated to about 8 cc., 1 cc. of glacial acetic acid added, then 90 cc. of 95° alcohol, which precipitates the calcium malate only or the malate and nitrate if the wine contains citric acid. The solution is filtered and washed

with 85° slightly acetic alcohol. The estimation of the calcium in the filtrate gives the corresponding succinic acid. By treating in the same way the precipitate left on the filter, which is re-dissolved with boiling water, the malic acid is determined.

II. — SWEET WINES. — The wines are subjected to a preliminary treatment to separate the tannins, then acidified with normal  $H_2SO_4$ . The mixture is evaporated till syrupy, the lead shot added, together with 10 to 12 cc. of alcohol according to the amount of sugar and finally 50 cc. of ether a little at a time, shaking the lead meanwhile. A white emulsion, which turns into a syrupy liquid is formed. After it has been left for a short time the ether alcoholic liquid is poured on to a filter, and the extraction with alcohol and ether repeated 2 or 3 times. The mixture is then distilled, and the alcoholic residue contains the soluble acids. The mixture is evaporated to dryness in an evaporating dish and the dry extract obtained treated as in the case of unsweetened wines, or those poor in sugar.

The proportion of succinic acid in normal wine is about 0.70 gm. per litre, whereas the amount of lactic and malic acid varies considerably according to the origin and state of preservation of the wine.

462 — **Alcoholic Fermentation of the Jerusalem Artichoke.**— See No. 399 of this *Review*.

463 — **Characteristics and Quality of Montana Grown Wheat.** — LEVI, M. THOMAS, in *U. S. Department of Agriculture, Bulletin No. 522*, 34 pp., 13 Tables, 17 Fig. Washington, D. C., May 18, 1917.

Five distinct commercial classes of wheat are produced in Montana, which may be conveniently designated as hard spring, hard winter, western red, western white, and durum. The two first-named classes are of about the same milling quality, except that the spring wheat is decidedly superior in baking strength. The wheats of these two classes also resemble each other closely in physical characteristics and composition; both are best suited for the production of a bread flour.

The flour from the western red and western white wheat is very low in strength and absorption and has the general characteristics of other soft wheat flours. The flour is best adapted for the production of crackers and pastry products. The bread produced from this wheat is very close textured and heavy. Durum wheat is decidedly different from the wheat of any other class. Although generally yielding a high percentage of flour, the flour is usually very creamy or yellow in colour and consequently receives a low score for colour. In spite of the fact that the flour contains a very high percentage of crude protein (13.84 % in the 3-year average 1908, 1911-1912 of the analysed samples) it falls between the hard winter and western red wheats in baking strength. In water absorption the flour is slightly superior to that of all other classes. The flour from this wheat is not popular for bread-making purposes on account of its creamy colour but it is especially adapted for the manufacture of macaroni and similar products.

A comparison of the average results of tests with the wheat of the five classes is presented in the annexed table.

*Average results of all baking tests of each of the five classes of Montana wheat.*

Class of type	Number of samples	Yield of straight flour	Colour of bread	Tests of straight flour						Crude protein in wheat N $\times$ 5.7	Moisture in wheat
				Absorption of water	Strength		Crude protein in flour N $\times$ 5.7	Moisture in flour			
					Volume of loaf *	Texture of loaf					
		per cent.	Score	per cent.	C. c.	Score	per cent.	per cent.	per cent.	per cent.	
Hard red spring, 5 year average, 1908 to 1912 . . . . .	27	71.1	98	56.4	2.342	96	11.98	10.47	12.47	13.1	
Hard red winter, 5 year average, 1908 to 1912 . . . . .	79	71.8	97	57.1	2.142	94	11.73	9.89	12.20	12.4	
Durum, 3 year average, 1908, 1911, and 1912. . . . .	7	76.1	88	57.6	1.934	90	13.58	9.78	13.84	12.3	
Soft red winter (Western red), 4 year average, 1908 to 1911 . .	13	68.5	98	53.6	1.787	84	10.38	10.05	11.08	12.3	
Soft white wheat (Western white), 5 year average, 1908 to 1912. .	11	66.7	96	50.9	1.756	85	9.16	9.98	10.12	12.2	

(\*) 340 grams of flour were used in each instance.

464 — **The Catalase Activity of American Wheat Flours.** — BAILEY, C. H. (Division of Agricultural Bio-chemistry, Minnesota Agricultural Experiment Station), in *The Journal of Biological Chemistry*, Vol. XXXII, No. 3, pp. 539-545, 1 Table, 1 Fig. + Bibl. of 8 publications. Baltimore, December, 1917.

Nearly all animal and vegetable tissues have the power to decompose hydrogen peroxide with the evolution of molecular oxygen. This power was attributed to the action of several enzymes, till LOEW showed it to depend on one enzyme only, found in all living tissues, and called by him catalase. Its action, according to LOEW, is to destroy the peroxides, formed in the living cells by the action of other enzymes, called oxidases. This decomposition liberates the oxygen and isolates the radical of the peroxide. The presence of finely divided metals (spongy platinum, lead peroxide, manganese dioxide, etc.) also greatly hastens the decomposition of the hydrogen peroxide. The action of the catalase, however, shows it to be an enzyme; its activity is increased by raising the temperature 1.5 to 1.7 times per 10° C.; in a moist medium its activity is inhibited by a temperature of 70° C., although, in a dry medium, it remains active even at 100°. Certain toxic substances, such as hydrocyanic acid, hydrogen sulphide, ammonium, metallic nitrates, etc., make it inactive. These are properties common to all the diastases.

Many authors, particularly in Germany, had already shown that the quality of flour may be judged by the quantity of oxygen liberated from the hydrogen peroxide (WENDER, LEWIN, LIECHT, RAMMSTEDT), but most of the work done in Europe has not received sufficient attention in Europe. For this reason the author wished to ascertain whether the relation between the quality of the flour and the rate of decomposition of hydrogen peroxide also existed for American flours.

**APPARATUS AND METHOD.** — A 500 cc. capacity flask, submerged in a water bath kept at 20° C., is fitted with a three-holed rubber stopper; through

one of these holes is passed a 30 cc. separating funnel, with open top, through the second a delivery tube, through the third a tube connected with a 100 cc. Hempel-Winkler burette. All the tubes are fitted with glass stopcocks, and care is taken to see that the joints are tight.

One gram of flour is placed in a mortar and triturated with about 25 cc. of distilled water. This is poured into the flask, together with the washings from the mortar, and water added till a total of 100 cc. is reached. When the mixture is at the temperature of the thermostat (20° C.), 5 cc. of a perhydrol (30%  $H_2O_2$ ) solution made up of 1 part perhydrol and 4 parts water, is introduced through the funnel. When the water level in the burette is at zero, the stop-cock of the delivery tube and that of the funnel are closed, and the stop-cock of the tube communicating with the burette opened. Two readings are taken, one after 30 minutes, the other after 1 hour. The volume of gas in the burette is corrected to 20°C. and a pressure of 760 mm.

RESULTS AND CONCLUSIONS. — The appended table shows the results obtained from many flours supplied by various mills. The ash content is expressed in per cent., and the oxygen evolved in 30 and 60 minutes respectively in ccs. per 1 gm. of flour, and it is seen that, though the parallelism between the two is not exact, it is very close. With double the ash content the catalase activity increases about 340 % with treble the ash content, the activity increases about 500 %. The catalase activity, therefore, increases much more rapidly than the ash content, thus offering an advantageous method for grading flour which will dispense with the costly apparatus, — muffle furnace, platinum crucibles, etc. — generally used.

*Catalase activity tests of American Wheat flours.*

Mill supplying sample	Quality of flour	Ash content	Catalase activity cc. of $O_2$ evolved	
			in 30 minutes	in 60 minutes
Mill A., 5000 barrels capacity	Patent (bolted at more than 70%)	0.36	6.9	11.6
» » » » »	1st clear ( » less than » 40%)	1.04	41.1	52.4
» » » » »	2nd » ( » » » 40%)	2.00	58.9	97.2
Mill B., 1000 barrels capacity	83 % Patent . . . . .	0.42	10.2	14.2
» » » » »	100 % Straight . . . . .	0.48	16.1	22.9
» » » » »	17 % Clear . . . . .	0.72	34.9	45.1
Mill C., 850 barrels capacity	"A" Grade . . . . .	0.49	14.1	20.6
» » » » »	"L" » . . . . .	0.54	16.7	26.2
» » » » »	"T" » . . . . .	0.93	38.4	51.6
» » » » »	"B" » . . . . .	1.42	72.4	80.0
Mill D., 500 barrels capacity	80 % Patent . . . . .	0.43	5.5	11.5
» » » » »	Straight . . . . .	0.48	12.6	19.9
» » » » »	20 % Clear . . . . .	0.86	30.1	43.4
	Straight . . . . .	0.45	5.7	9.1
	» . . . . .	0.46	6.4	10.7
Flour bolted at 100 % from	» . . . . .	0.47	6.5	11.0
various sources . . . . .	» . . . . .	0.48	6.6	11.5
	» . . . . .	0.49	6.6	11.6
	» . . . . .	0.50	8.9	14.6
	» . . . . .	0.52	12.0	20.2

473 - **The Colon-Aerogenes Group from Silage.** — HUNTER, O W. (Bacteriological Laboratory, Kansas Agricultural Experiment Station), in the *Journal of Bacteriology*, Vol II, No. 6, pp 635-639; bibliography of 7 publications Baltimore, November, 1917.

A study of silage fermentation has shown the *colon* group to be a pre-dominating type in the early stages of ripening. Analyses of many samples of alfalfa, sugar-cane, maize and kafir forage at the time of filling the silo, gave counts varying between 1000 to 1 000 000 of these organisms per gram of fodder: Examination of various forage collected in the fields under aseptic conditions showed their presence in numbers ranging from 1000 to 100 000 organisms per gram. This shows that the common forage crops are natural hosts of the *colon-aerogenes* group, and that the large numbers found on the forage as it enters the silo are not due to contamination though handling and cutting, but represent, in a majority of cases, the actual number living in the forage.

Numerous workers have reported the presence of the *colon* group on grains, grasses and flowers, but have not agreed whether the presence of these organisms is due to faecal contamination or whether they represent a specific type characteristic of grains.

The author's preliminary investigations show that the *colon-aerogenes* group, common on forage, finds there an environment favourable to growth. Alfalfa was grown in the laboratory, all sources of contamination, except those from the soil, being prevented. Over 100 000 coli-like organisms per gram were found. The only possible source of infection from such organisms was through the root-system, which did not seem likely, or through contamination from the soil as the plants broke through, a source of undoubted importance.

The purpose of the author's experiments was to study the physiological activities of the *colon aerogenes* groups present in silage. He studied these activities in 110 cultures divided into four groups — *Bacillus coli-communis*, *B. coli-communior*, *B. (lactis) aerogenes*, *B. acidi (lactici)*. Of these cultures, 95 were isolated from various kinds of silage (53 from alfalfa, 39 from kafir, and 3 from maize), and 15 from alfalfa and kafir collected in the field under conditions as aseptic as possible.

The results showed 48.18 % of the microorganisms to be *B. (lactis) aerogenes*, 30.9 % *B. coli-communior*, 10.9 % *B. coli-communis* and 10 % *B. acidi (lactici)*. Classified according to origin by differentiation with methyl red, 79.08 % were of non-faecal strains and 20.9 % of faecal origin. All the strains represented by the *B. coli communis* and *B. acidi (lactici)* groups were faecal types, whereas those of the groups *B. coli communior* and *B. (lactis) aerogenes* were non-faecal types. A correlation between the Voges-Proskauer reaction and hydrogen-ion concentration was observed in all cultures; all cultures with a high hydrogen-ion concentration gave a negative Voges-Proskauer reaction, those with a low concentration gave a positive reaction. Litmus milk was coagulated by 90.9 % of all faecal strains, while 98.5 % of the non-faecal types showed only an acid reaction.



- 474 - **Preservation of the Roots of Jerusalem Artichoke.** — GÉNIN, JOSEPH, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 1, pp. 64-65. Paris January 9, 1918.

It is well known that, in April, the root grows, and that, in spite of all precautions, it empties and can no longer be used.

The author successfully employed the following method on his farm at Bourgain (Isère): — In March the whole harvest is gathered into a shed; the artichokes are passed through a root-washer and a root-cutter. They are then piled in empty wine casks. Before long they float in their own water; they are then weighted with a few stones and left till July or August when they are fed to livestock.

- 475 - **Cold Storage Butter.** — Abstract from the *National Food Magazine*, U. S. A., in *Cold Storage*, Vol. XXI, No. 238, pp. 10-11. London, January 17, 1918.

The preservation of the flavour of butter during cold storage has been the subject of close investigation by Dr. DON C. DYER, chemist to the Dairy Division of the U. S. Department of Agriculture. Dr. DYER's experiments show that the disagreeable flavours which arise in butter during cold storage result from a chemical change, caused by the slow oxidation of one or more of the non-fatty substances of the butter-milk; they are not due to oxidation of the fat itself. Moreover, the extent of this chemical change is in proportion to the acidity of the cream with which the butter is made. Dr. DYER overthrows certain accepted chemical theories. He believes that olein, which forms 35 % of the non-volatile constituents of butter fat, oxidises with great difficulty, and, probably, absorbs no oxygen whatever. For this reason the fault must be searched for elsewhere.

It is the butter-milk which, according to Dr. DYER, supplies the substance which decomposes during cold storage, and this decomposition is in proportion to the degree of acidity of the butter; the higher the acidity, the greater the decomposition. In order to avoid this decomposition, the dairyman who makes butter for cold storage must not use cream which is too acid, or, if he is obliged to do so, he must wash the butter well so as to free it, so far as possible, from the butter-milk. Butter made from fresh cream of low acidity is best for preserving, and at the present day, in the United States, all butter for the navy must be so made. Butter made with acid cream is suitable for immediate consumption, but not for cold storage. Navy butter was obtained as a result of a series of churning experiments on cream of various degrees of acidity. The degree admitted in the trade is from 0.5 to 0.6 % or even more. Butter as ripe as this is not suitable for cold storage, whereas the experiments showed butter having an acidity of from 0.2 to 0.3 % to keep perfectly. The United States navy butter meets the following requirements: — it must be made with pasteurised cream containing not more than 0.234 % of acid; it must not contain more than 13 % of water; the salt content must be between  $2\frac{1}{2}$  and  $3\frac{1}{4}$  %. This butter is stored at a temperature of 0°F. or less.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

476 - Fungi, Insects and Animals Injurious to Cultivated Plants in Norway in 1916. — SCHÖYEN, J. H., in *Aarsberetning angaaende de offentlige foranstaltninger til landbruksfremme i Aaret*, 1916, pp. 39-94, 2 f. Fies Christiania, 1917.

The plant pathology service in Norway is in the hands of a state entomologist helped by a specialist in mycology, so that, by a rational distribution of the branches of the work, results of increasing utility may be obtained. The central Bureau receives from all over the kingdom information on the appearance of diseases and injurious insects or animals; the material received is examined and instructions and information necessary to control pests of agriculture are given.

In 1916 the Director visited repeatedly the various districts and many agricultural centres, either to superintend the methods of control or to give lectures on questions and branches of plant pathology. The visits numbered 104 in all.

A course of 82 hours on plant pathology was also given at the High School of Agriculture, Christiania.

The law of July 21, 1916, gives detailed regulations regarding the importation of seeds and nursery plants, the isolation and disinfection of infected districts, the distribution of fungicides and insecticides, and the duties of the officers charged with superintending the execution of the law. By this law are considered injurious to agriculture in Norway: *Puccinia graminis* ("sortrust"), *Synchytrium endobioticum* ("potetkraeft"), *Sphaerotheca mors-uvæ* ("stikkelsbaerdraeperen"), *Tarsonemus fragariae* ("jordbaermidde"), *Euthrips pyri* ("paerens Blaerfot"), *Denarolimus pini* ("furuspinderen"), *Lymantria monacha* ("nonne").

The reports received at the Central Bureau in 1916 numbered 1102, distributed as follows:

Diseases attacking.	Caused by		
	Insects or other animals	Bacteria and fungi	Other causes
Agricultural and market garden crops . .	90	117	9
Fruit trees . . . . .	163	94	31
Berry-bearing shrubs. . . . .	54	90	11
Ornamental plants. . . . .	35	15	7
Foods, etc. . . . .	77	2	—
Parasites of man and animals . . . . .	28	—	—
Evergreens . . . . .	48	35	28
Deciduous trees . . . . .	29	9	12
<i>Total</i> . . .	524	362	98

The number of reports received from each district were: Smaalenenes, 58; Akershus, 292; Buskerud, 76; Jarlsberg and Larvik, 40; Hedemarken, 108; Christiania, 42; Bratsberg, 88; Nedenes, 35; Lister and Mandal, 63; Stavanger, 29; S. Bergenhus, 102; N. Bergenhus, 41; Romsdal 26; S. Trondhjem, 23; N. Trondhjem 27; Nordland, 14; Tromsø, 8; Finmarken, 4.

The most important data are given below, mention being made of the pests reported for the first time in Norway, and those already known there which have caused serious damage to agriculture in special districts.

CEREALS. — Larvae of *Tipula oleracea* ("kaalstankelbenet"), on barley and oats at Fyrisdal; larvae of *Hydrellia griseola* ("kornbladflue") on oats in the Trondhjem district; *Oscinella frit* ("fritflue") on oats and barley at Saetersdalen and at S. Land; *Cecidomyia aurantiaca* ("orangegule hvetemyy"), reported for the first time as injurious in Norway, where it was found in wheat fields at Dilling (Smaalenenes district). The two common aphids *Aphis avenae* ("havrebladlusen"), *Macrosiphum granarium* ("kornbladlusen") and *Thrips denticornis* ("blærefølter") did ever-increasing damage.

Among the fungi are mentioned the common species of *Ustilago*, *Tilletia*, *Puccinia*, *Erysiphe*, *Pleospora*, etc. The decree of September 8, 1916, gives measures for controlling *Puccinia graminis* by destroying plants of *Berberis vulgaris*.

POTATOES. — *Synchytrium endobioticum* ("potetkraeft") appeared in 1914 in the Kristiansand district in two localities near Grimsmo; by order of the Department of Agriculture the infected plants were immediately uprooted and the soil disinfected with a 1 % formalin solution, and it was strictly forbidden to plant tomatoes or potatoes in the infected zone for at least 6 years. In spite of these precautions the disease spread in 1915 and was reported from 27 other localities. From this moment the government spared no efforts to suppress this pest; it gave special facilities for the purchase of disinfectants, held lectures, distributed pamphlets, and finally issued the decree of September 8, 1916, which, besides regulat-

ing the control, imposed penalties on those farmers who, instead of co-operating with the State, attempted to evade the law. At Selbusstranden considerable damage was also done to potatoes by *Limax agrestis* ("aker-snegl").

VEGETABLES. — *Barynotus squamosus* caused huge losses in cabbages at Grytten, in the district of Romsdalen. To the author's knowledge this species, common in Europe, never did damage there, but imported into Canada, it ranks in that country amongst the insects most injurious to young cabbage plants.

At Stavanger, carrots suffered from the attacks of *Pseudomonas destructans* ("hvitraate"). All the varieties of carrots are not equally subject to *Pseudomonas*; while the Greystone variety is very easily attacked, "hvite maiturnips" is very resistant.

FRUIT TREES. — The winter 1915-1916, which was exceptionally severe, did considerable damage to trees, thus decreasing their resistance to insects and fungi which, together with adverse meteorological conditions during flowering, contributed to compromise seriously the crop. Larvae of *Euthrips pyri* ("paerens blaerefot"), which appeared in Norway for the first time in 1914, were frequently reported in 1916 as doing damage to fruit trees. For the moment the damage is slight, but as this insect is already known to be very injurious in North America, it is best to look for it and to take measures to destroy it immediately it appears. The mixture recommended consists of:—

4 % tobacco juice . . . . .	¼ litre
Water . . . . .	380 "
Soap or . . . . .	6 ½ to 15 ½ lbs
Paraffin emulsion . . . . .	8 ¼ litres

The mixture is applied three times: — 1) when the buds begin to swell; 2) when the inflorescences begin to open; 3) immediately after the flowers fall.

*Sphaerotheca mors-uvae* ("stikkelsbaerdraeperen") has spread considerably of recent years in the southern and eastern provinces of Norway and has done serious injury to gooseberry plantations. The decree of September 8, 1916 makes it obligatory for orchard owners to report this disease; it is moreover, strictly forbidden to plant gooseberries in the districts of Finnmarke, Tromsø, Nordland, Nordre Trondbjem, Søndre Trondbjem, Romsdal, and Nordre Bergenhus. In the experiments with different fungicides carried out by the State entomologist on behalf of the Department of Agriculture were used: —

1) a 0.4 % formalin solution (1 litre of 40 % formalin solution in 1 hectolitre of water); 2) 0.8 % formalin solution (1 litre of 40 % formalin solution in 50 litres of water); 3) 1.6 % formalin solution (1 litre of 40 % formalin in 25 litres of water); 4) sulphur-lime mixture (30° Beaumé, 25 % sulphur), 1 litre in 10 litres of water; 5) 55 % nitric acid, 2 litres in 1 hectolitre of water; 6) a 4 % sodium chloride solution with a little lime. Six plots were chosen, one being used as control. The efficacy of the fungicide was esti-

mated by the number of healthy plants expressed in percentage of the total number of plants in each plot. The results obtained were :

1.6 % formalin <sup>1</sup> . . . . .	87.50 % healthy plants
0.8 % " . . . . .	81.25 % " "
Sulphur-lime mixture. . . . .	78.13 % " "
Nitric acid . . . . .	53.13 % " "
Sodium chloride solution . . . . .	50.00 % " "
0.4 % formalin . . . . .	31.25 % " "
Control plot . . . . .	14.29 % " "

The best results, therefore, were obtained with 1.6 % formalin.

477 — **Fungi of Eritrea and Abyssinia.** — BACCARINI, PASQUALE, *Annali di Botanica*, Vol. XIV, Pt. 3, pp. 117-140. Rome, 1917.

The list includes 110 fungi isolated at different times by different botanists, chiefly in Eritrea, but also in Abyssinia. There are many species new to science, and several are new to the country explored ; others, which had already been reported there are now given as existing in new districts.

The following should be noted : —

1) *Melampsora Ricini* Pass., on leaves of '*Ricinus communis*,  $\beta$  africanus, at Nefasit (Eritrea);

2) *Puccinia Pruni-spinosae* Pers., on leaves of peach at Asmara (Eritrea) ;

3) *P. purpurea* Cke., on leaves of dhari and *Pennisetum spicatum* at Uechiro (Eritrea) ;

4) *Ustilago avenae* (Pers.) Jens. var. *levis* Kell. and Sw., on *Avena abyssinica*, at Asmara ;

5) *U. Hordei* (Pers.) Kell. and Sw., on *Hordeum* sp., at Asmara ;

6) *Sphacelotheca Sorghi* (Link) Clint., on dhari in Eritrea (Uechiro, Carcabat, Hari-Ieli, Addi-Cajè) and in material from the Ruspoli expedition without any indication of locality ;

7) *Graphiola Phoenixis* (Moug.) Poit., on *Phoenix* sp. at Asmara ; on *Ph. dactylifera*, at Archico and Embatcalla ; on *Ph. abyssinica* at Aidereso ;

8) *Exoascus deformans* (Berk.) Fuck., on leaves of peach at Asmara ;

9) *Sclerospora macrospora* Sacc., on maize, at Ghinda (Eritrea) ;

10) *Phoma Baldratii* n. sp., on stems of *Euphorbia Tirucalli*, at Addi-Ugri ; fungus evidently parasitic ;

11) *Septoria Dianthi* Desm., on leaves of *Dianthus Caryophyllus*, cultivated at Asmara ;

12) *S. graminum* Desm., on leaves of *Hordeum* sp., at Asmara ;

13) *Cercospora Raciborski* Sacc. and Syd., on leaves of *Nicotiana* sp., at Cheren ;

Mention is also made of *Bacillus Oleae* (Arc.) Trev., on leaves of rose-bay grown at Addi-Ugri.

478 — **The Resistance of Peanuts to *Sclerotium Rolfsii*.** — MCCLINTOCK, J. A., in *Science*, New Series, Vol. XLVII, No. 1203, pp. 72-73. Lancaster, Pa., January, 18, 1918.

Already in 1916 the author had collected at the Virginia Truck Experiment Station, Norfolk, Virginia, data concerning the difference between

[476-477]

peanut varieties in their sensibility to attacks of peanut-wilt (*Sclerotium Rolfsii*).

The soil of the plots in which the rotation experiment with this plant was made was known to be thoroughly infected by *Scl. Rolfsii*, and the Valencia variety had proved very subject to the attacks of this fungus. For this reason the Valencia variety was not included in the rotation experiment, its place, for the 1917 crops, being taken by commercial seed of the Virginia Bunch variety. Two plots were used for the 1917 crops; in one peanuts had been grown continuously since 1910, but in the other only in 1911 and 1914.

The two plots were observed up to harvest time (November 9, 1917). During this time a faded Virginia Bunch plant was found in each. An examination of the lower part of the stem showed the presence of mycelium of *Scl. Rolfsii*, proving the disease to be due to this fungus as in many cases in 1916.

The fact that none of the Virginia Runner plants faded confirmed the data of 1916 which showed this variety to be practically immune to wilt.

The resistance of the Virginia Bunch variety was much more marked in 1917 than in the preceding year. Whereas, in 1916, 60 out of 132 plants died, in 1917 only 2 out of 7 000 plants in the same soil were attacked by the disease.

These data are of practical value, especially in the south of the United States, where the peanut is being grown to an increasing extent in districts infested with boll-weevil (*Anthonomus grandis*), and where *Scl. Rolfsii* is already a serious parasite of many crops.

DISEASES  
OF VARIOUS  
CROPS

479 — On a Sudden Outbreak of Cotton Rust (*Aecidium Gossypii*) in Texas. — TAUBENHAUS, J. J., in *Science*, New Ser., Vol. XLVI, No. 1185. pp 267-269. Lancaster, Pa., September 14, 1917.

In 1917 an outbreak of cotton rust (*Aecidium Gossypii* E. and F.) occurred in different parts of Texas. The author's attention was first called to it on June 10, 1917, and the first specimens were collected at Mercedes and Edinberg.

The disease is characterised by round spots of varying size on the leaves of the plant. The aecidia develop on the upper part of the leaf. The disease seems to attack first the lower leaves, and especially well-developed plants on which the cotton bolls are already large. The bracts of the plants may also be affected, but the disease has never been found on the stem.

In his herbarium Dr. J. C. ARTHUR has specimens of this fungus collected by HEALD and WOLF at Falfurrias, Texas, on September 2, 1909, and two Mexican collections, one from San Jose del Cabos (September 2, 1893), the other from Tlahualilo, collected about 1907, probably by HERRERA. Dr. W. A. ORTHON also has specimens of this rust, collected at Miami, Florida, and others from Falfurrias and other parts of the Rio Grande valley, collected seven years ago. This shows that *A. Gossypii* was already present in Texas and elsewhere although it did not attract the attention of cotton-growers or pathologists.

Nothing definite is known as to the origin of the 1917 outbreak. Studies

are now being made with the object of determining the plant host of the perfect form (*Puccinia*) of this rust.

480 - **Vegetable Parasites of the Cacao-Tree in the State of Bahia, Brazil.** — See No. 493 of this *Review*.

481 - **Diseases and Pests of the Onion in Illinois, U. S. A.** — See No. 422 of this *Review*.

482 - **A *Phyllachora* of the Royal Palm in Cuba.** — JOHNSTON, J. R. and BRUNER, S. C., in *Mycologia*, Vol. X, No. 1, pp. 13-14, 1 Plate. Lancaster, Pa., January, 1918.

Recently while examining specimens of royal palm (*Roystonea regia* Cook) near Rincón (Cuba), the authors noticed on the midribs of the leaves, conspicuous black, charcoal-like masses of a fungus, several centimetres long. The masses were composed of more or less confluent groups of stromata developed beneath the epidermis of the host. The fungus was also present on the leaf segments, but development there was much less considerable than on the midrib.

An examination of the fungus showed it to be a *Phyllachora* (family Dothideaceae), which appeared to be distinct from the other species already described. It is distinguished from the other species living on palms, especially by the large size of its asci. The authors describe it here under the name of *Phyllachora Roystoneae*.

Hitherto this pyrenomycete has only been observed on a few palms and does not seem to do serious damage.

483 - **An Unidentified Fungus Injurious to the Conifer *Cedrus Deodara* in India.** — GLOVER, H. M., in *The Indian Forester*, Vol. XLIII, Nos. 11-12, pp. 498-499, 1 Plate. Allahabad, 1917.

A fungus which, according to the author, has not yet been identified, does great damage to *Cedrus Deodara* in the young regeneration plantations of the driest districts of the Bashar Division. So far as is known it does not exist where there are marked differences in rainfall.

The plants are attacked when about 1 ft. in height; those growing in the shade die first.

The plants attacked have a characteristic appearance. They are covered with spots; as a rule the leaves of the lowest branches turn brown first and die, the other branches being then infected. Sometimes the highest branches are attacked first and develop green spots; dying and dead leaves are seen on them at the same time. Sometimes the tree resists the attack, and large plants are found the lowest branches of which have been killed, the others remaining healthy; but more often the young seedlings and plants are completely killed.

If the roots are carefully examined, a yellowish-white mycelium is found, which seems to show that the fungus attacks the tree by the roots.

Up to the present the only method of controlling this fungus consists in cutting down the diseased trees, but the result has been unsatisfactory. Probably a more efficacious method would be to clear the ground so as to allow the young *C. Deodara* to develop under more favourable conditions. Control is necessary, for the disease threatens to do most serious damage in the regeneration districts, *i. e.*, those obtained after the regular regeneration pruning of 1905-1907.

## WEEDS AND PARASITIC FLOWERING PLANTS

484 — **Some Farm Weeds in Sindh, India.** — KAZI, A. M., in *The Poona Agricultural College Magazine*, Vol. VIII, No. 3, pp. 179-182. Poona, January, 1917.

Owing to the canal system of irrigation it is possible to grow crops of "kharif". As a result of the irrigation and absence of suitable cultural methods all the fields are infested with weeds, no precautions being taken to eradicate them. The only method adopted is to cut the weeds when they are sufficiently high and to feed them to livestock.

A list is given of some of the common weeds of the province, together with a short descriptive note on each of them.

1) *Eragrostis cynosuroides* Beauv. ("dubh"); 2) *Eleusine aegyptiaca* Desf. ("mandhani"); 3) *E. flagellifera* Nees ("gandheer"); 4) *Cynodon Dactylon* Pers. ("chabar"); 5) *Panicum colonum* L. ("savri"); 6) *Andropogon annulatus* Forsk. ("dinuhi"); 7) *Cyperus rotundus* L. ("kabah"); 8) *Cleome viscosa* L. ("dhanar-khathuri"); 9) *Digera arvensis* Forsk. ("lulur"); 10) *Euphorbia hypericifolia* L. ("kherol"); 11) *Tribulus terrestris* L. ("sarang").

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

## GENERAL

485 — **Observations on British Coccidae** (1). — GREEN, E. E., in *The Entomologist's Monthly Magazine*, Vol. LIII (3rd. Ser. Vol. III), No. 642, (35), pp. 260-264, 2 figs., No. 643 (36), pp. 265-269, 2 figs. London, November-December, 1917.

This fourth contribution includes the following species: —

1) *Physokermes abietis* Geoffr., abundant at Camberly on some small spruces and on many other spruces in the neighbourhood;

2) *Gossyparia ulmi*. Geoffr.; the young Cornish elm (*Ulmus campestris* var. *cornuliensis*) upon which the insect had been previously found (2) had been transplanted into the author's garden, where he was able to observe the life cycle of the insect; another small colony of *G. ulmi* was found by Mr. FRYER on a golden elm (*U. Dampieri* var. *aurea*) in a nursery at Knap Hill;

3) *Eriococcus devoniensis* Green; the author received from Dr. IMMS typical samples of this species taken at Newchurch Common, Dclamere, Cheshire, although this is the third locality only — the other two were Budleigh Salterton, Devonshire, and Camberley, Surrey — from which *E. devoniensis* has been reported, it probably exists wherever cross-leaved heather (*Erica tetralix*, not *E. cinerea* as stated in the original description) grows freely (3).

4) *Rhipisia halophila* Hardy, found at Camberley on roots of grasses, under stones.

(1) See R. Oct., 1917, No. 975. — (2) See R. June, 1916, No. 706. — (3) See B. Aug., 1915, No. 867 (Ed.)



5) *Pseudococcus nipae* Mask., the author received from Mr. Fyler living specimens of this species from *Kentia* sp. at London; later it was also found at the Royal Botanic Gardens, Kew (1);

6) *Ps. walkeri* Newst., found by Mr. H. Donisthorpe at Goring Woods;

7) *Ps. longispinus* Targ., on bananas bought at Camberley;

7a) *Ps. longispinus* Targ. var. *latipes* n. var. on a fuchsia in a greenhouse at Camberley; other specimens have been collected at Manchester, where they infest the cactus-houses.

8) *Ps. newsteadi* n. sp., on beech (*Fagus sylvatica*) at Camberley; larvae, presumably of the same species, were found by Mr. E. G. JOSEPH in unopened leaf-buds of beech at Chartridge, Bucks;

9) *Aspidiotus lataniae* Sign.; the author has specimens of this coccid taken on *Dracaena* at Tooting in 1899; this species has apparently not yet been recorded from the British Isles;

10) *Lepidosaphes gloveri* Pack.; this species, which has not previously been reported in British lists is often found on the rind of imported oranges;

11) *L. desmidioides* n. sp. on *Nephrodium* sp. in the Royal Botanic Gardens, Kew;

12) *Kuwania gorodetskia* Nasonov (2); after having reported this species on birch at Camberley in 1914, the author did not find it again till June, 1917, when it reappeared in some abundance; three dead and partially decayed males were found in the woolly material of the ovisacs, but it is doubtful whether they really belonged to this species; they had none of the special characters common to the males of other *Margarodinae*, but were more like those of a *Pseudococcus*; should these males be proved really to belong to the *gorodetskia*, the species must be removed from the genus *Kuwania* and returned to the genus *Steingelia*, which, in its turn, must be removed from the sub-family *Margarodinae*; the apparent disappearance of the insect for two years may possibly indicate an unusually prolonged nymphal period.

486 — **Animal Pests of Cultivated Plants in Norway, in 1916.** — See No. 476 of this Review.

487 — **African Aphididae.** — THEOBALD, FRED. V., in *Bulletin of Entomological Research*, Vol. VIII, Pts. 3-4, pp. 273-294, 15 Figs. London, February, 1918.

The author deals particularly with the following species, many of which are described for the first time as being new to science:—

1) *Macrosiphum dahliaefolii* n. sp., on leaves of *Dahlia* at Kampala (Uganda);

2) *Aphis durantae* n. sp.; on main and secondary veins, particularly on the upper surface of *Durania* leaves, at Ghezireh (Egypt);

3) *A. zizyphi* n. sp., at the extremities of young shoots of *Zizyphus Spina-Christi*, at Gizeh (Egypt);

4) *A. ficus* n. sp., abundant on leaves of *Ficus Sycomorus*, especially on those attacked by the Sycamore Fig Tree *Psylla*, in Egypt (Cairo, Gizeh), and in Uganda (Kampala);

(1) See R. Oct., 1917, No. 976 — (2) See B. Aug., 1915, No. 867 (Ed.)

5) *A. tamaricis* n. sp., on *Tamarix* sp., at Gizeh; this is the only species reported on this plant;

6) *A. bauhiniae* n. sp., on leaves of *Bauhinia*, at Gizeh;

7) *A. buddleiae* n. sp., abundant on leaves of *Buddleia madagascariensis*, at Cairo;

8) *A. mathiolae* n. sp., on ornamental stocks, at Ghezireh;

9) *A. mathiolellae* n. sp., with the preceding species, in the same district;

10) *A. pruniella* n. sp., on plum tree, at Nairobi (British East Africa);

11) *A. pomonella* Theobald, on apple tree, in the same district;

12) *A. pheidole* Theobald, associated with ants (*Pheidole* sp.) at Mwen-gera (Rhodesia);

13) *A. acetosae* Koch (not Linn., Fabr., Buckton), on *Rumex* spp. and *Papaver* spp., at Ghezireh; the same species has been found in England (Wye, Kent), and in Germany;

14) *Siphocoryne* (*Aphis*) *pseudobrassicæ* Davis; Prof. DAVIS of Lafayette (Indiana) informed the author that he received this species from the Cape from Mr. LOUNSBURY; it lives on *Raphanus sativus*, *Brassica Rapa* var. *depressa*, *B. Napus*, *B. oleracea* var. *acephala*, *Sinapis*; DAVIS reports it at Geneva (New York), Evansville (Indiana), Lafayette and College Station (Texas);

15) *Hyalopterus insignis* n. sp., in colonies on the lower surface of leaves of *Arundo*, at Ghezireh;

16) *Myzus pterisoides* n. sp., on fern, at Kampala.

New districts and hosts are mentioned for the following species:

1) *Rhopalosiphum dianthi* Schrank, on *Brassica oleracea* and *B. oleracea bullata major* in large numbers, with *Aphis brassicæ* L., at Cairo and Ghezireh;

2) *Aphis* (*Siphocoryne*) *brassicæ* L., on the same hosts in the same districts, with *R. dianthi*;

3) *Hyalopterus pruni* Fabricius (*Hyal. arundinis* Fabricius, *Hyal. phragmiticola* Oestlund), previously reported from Cairo, on *Prunus* spp. and *Arundo*; recently found at Ghizeh in abundance underneath apricot leaves and also on *Arundo*, the effect of the aphid is more marked on leaves of peach than on those of apricot, the author himself never found this species on either peach or apricot trees in England, but received from Wood-bridge (Suffolk) living species taken from apricot trees.

#### RESISTANT PLANTS

468 - "4 F", a Variety of Cotton Resistant to Insect Attack in the Punjab, India. — See No. 419 of this Review.

#### MEANS

#### OF PREVENTION AND CONTROL

489 - The Control of Locusts in Cyprus. — See No. 376 of this Review

490 - Patents for the Control of Plant Pests. — See No. 458 of this Review

#### INSECTS, ETC., INJURIOUS TO VARIOUS CROPS

491 - *Tylenchus penetrans* n. sp., a New Nematode Parasite of Cotton, Potatoes and other Plants. — COBB, N. A., in *The Journal of Agricultural Research*, Vol. XI, No. 1, pp. 27-33, 5 Figs. Washington, D. C., October 1, 1917.

Under the name of *Tylenchus penetrans* the author describes, as a species new to science, a nematode which, already in 1911, he found to be injurious

to roots of *Viola* spp. at Rhinebeck, New York. It has been reported as a parasite of Upland cotton at Millington, North Carolina, and at Statesboro, Georgia, of potato roots near Kalamazoo, Michigan, and of *Cinnamomum* *Camphora* roots at Orlando, Florida.

The presence of the nematode may easily be recognised externally by the presence on the roots or tubers of small, abnormal lesions, a few millimetres in size; these are sometimes in the form of blisters, but more often in that of discoloured, slightly depressed spots. Each of these diseased spots, when fully developed, contains about fifty *T. penetrans* in various stages of growth.

The fact that this parasite is found under such varying climatic conditions and on such different hosts, shows that it is a species which adapts itself to most diverse conditions.

Nothing definite is known of the extent of the damage caused by *T. penetrans* to cotton and camphor, but the damage to *Viola* spp. is known to be very great. Information collected with reference to the potato shows the injury often to be considerable, so that great care must be taken to use only perfectly sound seed potatoes.

Mercuric chloride, used against potato scab (*Oospora Scabies*), has been found to reduce the vitality of the insect to a considerable extent.

492 - **Animal Pests of Onions, in Illinois.** — See No. 422 of this *Review*.

493 - **Insect and Vegetable Parasites of the Cacao-Tree in the State of Bahia, Brazil.**

TORREND C., in *Broter a, Serie de Vulgarização Científica*, Vol. XV, Pt. 6, pp. 263-279, 4 Figs and. *Serie Botânica*, Vol. XV, Pt. 3, pp. 106-127, 1 Fig., 4 Plates. Braga, 1917.

The State of Bahia has for some years been the principal centre of cacao-tree production. The last statistics show it to come immediately after the English Gold Coast Colony. The cacao-tree producing district occupies a large part of the south of Bahia, between latitudes 14° and 16° in the midst or in the place of huge virgin forests.

In view of its importance this crop has become one of the chief sources of revenue of the State. The news, therefore, that hitherto unknown diseases were appearing in the Ilheos and Itabuna plantations caused great alarm, and the government immediately nominated a Commission to study these diseases; the author was president of this Commission. The investigations showed the diseases to attack both the fruit and foliage of the trees.

Among the diseases of the fruit are: —

1) that commonly known among growers as "ferrugem" (rust), caused by *Physopus rubrocinctus*. The innumerable small holes made by the larvae of this thysanopteron, which forms numerous colonies on the fruit, cause an abundant secretion of the subepidermal tissues which eventually covers the whole surface of the fruit with a thin rust-coloured or brick red layer, making it impossible to recognise the ripe fruit at the time of harvest. The simplest preventative method of control would be to crush the colonies of the insect, after the fruit attacked has been completely and carefully surrounded with the hands. The use of insecticides is difficult

(1) See R. 1917, No. (Ed).

because of the size of the plantations. An enemy of this insect whose action seems very efficacious is an ant, commonly known as "caçarema", belonging, perhaps, to the species *Dolichoderus bituberculatus* (1), which should be protected and propagated, contrary to the custom adopted up to the present ;

2) numerous black spots, about 2 mm. in diameter, which cause more or less deep cancerous formations, and, generally, drying up of the green fruit. This disease is due to holes made by a hemipteron, closely resembling *Helopeltis antonii* (2), called provisionally by the author and Dr. ZEHNTNER *Mosquilla vastatrix*, because they believe it to be identical with the insect known to Equador planters as the "mosquilla" (little fly). Besides using a torch for burning the insects on the fruit, it is advisable to propagate the "caçarema" which probably destroys the eggs of this hemipteron ; the female insect, perhaps instinctively, never lays its eggs near this ant ;

3) a kind of rot characterised either by numerous spots, isolated at first, but converging later, or one single spot, yellowish or dark brown at first, then black, which begins at one extremity and finally covers the whole fruit. This rot is usually caused by *Phytophthora Faberi*, more or less associated with other microorganisms. To control this disease care must be taken to avoid lesions on the fruit, to burn or bury the remains of fruit as when they decompose in the air they form a seat for cryptogamic diseases. Care must also be taken to air thoroughly the infected parts of the plantation and to cut and burn contaminated fruit.

All the diseases which cause the leaves and young buds to dry up are known locally as "queima" (burn), but the causes are numerous, and among them the following may be specially mentioned :

1) the action of the adult *Physopus*, which pricks the young leaves ;

1) the holes made by *Mosquilla* in the buds and young leaves.

To control these pests, in additions to the methods already mentioned, it is advisable to keep the plantation well shaded ; the trees attacked should also be strengthened by rational lopping.

In the district examined the presence of epiphytic phanerogams and various species of fungi, largely saprophytic, was noticed. A fungus which should be specially mentioned is *Corticium lilacino-fuscum*, which lives on the green branches. Attention should also be drawn to a mycelium called by English workers "thread blight", which in every way resembles the mycelium of certain *Corticium*. It appears in the form of long threads on the branches and leaves ; the leaves are eventually enclosed in a sort of network and gradually dry up.

The chief cause of the diseases observed lies in the little care planters took of their large plantations in the past. To this must be added the use of unsatisfactory tools for the harvest and cultivation of the plants. The result is a large number of lesions which open the road to cryptogamic invasion. Another factor is also the atmospheric and climatic changes produced in these districts of recent years, due especially to the clearing of the virgin forests.

(1) See R., Dec., 1917, No. 1256 — (2) See R., June 1917, No. 614. (Ed.)

- 494 - *Euxoa excellens*, a Little Known Cutworm, in British Columbia. — GIBSON, ARTHUR, in *The Canadian Entomologist*, Vol. XLIX, No. 12, pp. 401-403. London December, 1917.

In British Columbia the larvae of *Euxoa excellens* Grt. have been so abundant in certain years that they have seriously damaged many varieties of vegetables. This species was first reported in 1885, when it did much damage in market gardens around Victoria, Vancouver Island. Larvae were also collected in British Columbia in 1888. In 1903 the insect was again troublesome on Vancouver Island, but, from that date it was not reported till May 30, 1916, when it was found at Sechelt near Vancouver. The larvae had damaged various vegetables, in some gardens spinach, lettuce, onion, etc. had to be sown three times before the end of May.

Larvae received at Ottawa in June, 1916, pupated early in July. Three specimens which pupated on July 2, produced moths on July 29 and 30. Other moths emerged in August. In the collections at Ottawa are three specimens reared by FLETCHER in 1885 from larvae collected in May; the dates of emergence were August 15, 18 and 22 respectively. According to the author's observations the moths of *E. excellens* fly, in British Columbia, in the latter half of August and during September. The insect, which was first described from Vancouver Island specimens, is widely distributed; it is found in the United States, in the States of Oregon, Colorado (in September) and in California (in September and October). Nothing definite is known of the early life history of the species; the winter appears to be passed in the egg stage; in certain seasons hibernation may also occur in the young larval stage.

After describing the mature larva, pupa and moth, the author adds that, from the larvae reared at Ottawa in 1916, were obtained several ichneumonid parasites belonging to the species *Amblyteles subfuscus* Cress. and *Ambly. nuncius* Cress; both species emerged in August. A large percentage of the larvae were destroyed by the fungus *Sorosporella uvella* (1).

Treatment at Sechelt with the well-known mixture of bran, Paris green and molasses gave very good results. By this method 95 to 100 % of the larvae was destroyed. Untreated plants were completely eaten up by the insect, which did not touch those to which the mixture had been applied.

- 495 - *Insects Injurious to the Cranberry in the United States* (2). — SCAMMELL H. B., in *United States Department of Agriculture, Farmers' Bulletin No. 860*, pp. 45, 39 Figs. Washington, D. C., 1917.

Commercial cranberry (*Oxycoccus macrocarpus*) growing is an intensely specialised industry, confined to certain districts of the United States, especially Massachusetts, New Jersey, Wisconsin, Long Island, and part of the north-western coast of the Pacific, near Columbia.

A morphological and biological description is given of the insects attacking the cranberry, most of which are also of economic importance for other plants, together with the most satisfactory measures of control.

The list includes: —

(1) See R. June, 1917, No. 611. — (2) See R., April, 1916, No. 470. (Ed.)

## a) Insects attacking the leaves :

- 1) *Rhopobota vacciniana* Pack. (blackhead fireworm) ;
- 2) *Peronea minuta* Rob. (yellowhead fireworm) ;
- 3) *Gelechia trialbamaculella* Cham. (red-striped fireworm) ;
- 4) *Dasyneura vaccinii* Smith (cranberry tipworm) ;
- 5) members of the *Geometridae* family (spanworms) ;
- 6) *Cirphis unipuncta* Haw. (army worm) ;
- 7) *Laphygma frugiperda* S. et A. (fall army worm) ;
- 8) *Systema frontalis* Fabr. (cranberry flea beetle) ;

## b) insects attacking the fruit : —

- 1) *Mineola vaccinii* Riley (cranberry fruitworm) ;
- 2) *Eniglaea apiata* Grote (cranberry blossom worm) ;
- 3) *Scudderella texensis* S. and P. (cranberry katydid) ;
- 4) grasshoppers — especially *Schistocera alutacea* Harr. and *Melanoplus bivittatus* Say — and members of the *Gryllidae* family (crickets) ;

## c) insects attacking the stem : —

- 1) *Crambus hortuellus* Hübner (cranberry girdler) ;
- 2) *Phylloscelis atra* Germar (cranberry toadbug) ;
- 3) *Amphisepea bivittata* Say (cranberry vinehopper) ;
- 4) *Clastoptera proteus* Fitch (cranberry spittle insect) ;
- 5) *Pseudococcus adonidum* L. (mealybug) ;
- 6) *Aspidiotus ancylus* Putnam (Putnam scale) ;
- 7) *Lepidosaphes ulmi* L. (oystershell scale) ;

## d) insects attacking the roots : —

- 1) *Rhabdopterus picipes* Oliv. (cranberry rootworm) ;
- 2) other coleoptera, especially *Phytalus georgianus* Horn., *Dyscinechus trachypygus* Burm. and *Lachnosterna grandis* Sm. (white grubs).

496 — **Important Pecan Insects Pests and Their Control** (1). — GILL, JOHN B, in *U. S. Department of Agriculture, Farmers' Bulletin* 843, pp. 1-48; Figs. 1-59. Washington, D. C., September, 1917.

The pecan (*Carya olivaeformis*) industry has developed rapidly in the south of the United States. This development has, however, been accompanied by a notable increase in the number and in the destructiveness of the insects attacking the crop. The loss from insect attacks amounts to hundreds of thousands of dollars annually and, in the absence of preventive measures, is certain to increase.

This bulletin gives the results of work done by the Bureau of Entomology on the most important insect pests of the pecan. The morphology and biology of each insect are described and the most efficacious means of control given.

The following species are discussed : —

## a) Insects injuring the nuts : —

- 1) Pecan nut case-bearer (*Acrobasis hebesella* Hulst.) ;
- 2) Pecan shuckworm (*Laspeyresia caryana* Fitch) ;

(1) See also R. Sept., 1917, No. 884. (Ed.)

- 3) Pecan weevil (*Balaninus caryae* Horn) ;
- b) Insects injuring the foliage and shoots : —
  - 1) Pecan leaf case-bearer (*A. nebulella* Riley) ;
  - 2) Pecan cigar case-bearer (*Coleophora caryaefoliella* Clem.) ;
  - 3) Pecan bud-moth (*Proteopteryx bolliana* Sling) ;
  - 4) Fall webworm (*Hyphantria cunea* Drury) ;
  - 5) Walnut caterpillar (*Datana integerrima* G. and R.) ;
  - 6) Hickory phylloxera (*Phylloxera caryaecaulis* Fitch) ;
  - 7) Little hickory aphid (*Monellia caryella* Fitch) ;
- c) Insects injuring the trunk and branches : —
  - 1) White ants ; of these *Leucotermes flavipes* Kollar is the most widespread and common in the eastern States ;
  - 2) Oak or hickory cossid (*Cossula magnifica* Strecker) ;
  - 3) Flat-headed apple-tree borer (*Chrysobothris femorata* Fab.) ;
  - 4) Red-shouldered shot-hole borer (*Sinoxylon*] *Xylobiops basilaris* Say) ;
  - 5) Belted chion (*Chion cinctus* Drury) ;
  - 6) Hickory twig-girdler (*Oncideres cingulatus* Say) ;
  - 7) Oak pruner (*Elaphidion villosum* Fab).

The pecan is not immune to attacks from scale insects, but on account of the limited infestation up to 1917 they are not included among the most important pests of this tree.





INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

## INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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### FIRST PART. ORIGINAL ARTICLES

#### **The Live Stock Industry in Australia.**

by

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In dealing with the Live Stock Industry in Australia it is necessary, in the first place, to draw attention to a few geographical details in order that readers may be familiar with the diverse conditions of soil and climate met with. The Continent has been settled for only a little over 100 years. It has an area of 2 974 581 square miles, being approximately three-fourths as large as Europe; 14 times as large as France; 24 times as large as the United Kingdom of Great Britain, and 26 times as large as Italy. It is situated between the 12th and 40th degrees of South Longitude. This will give some idea of the vast area, the great distances and the variation of climate and herbage met with. The influence of such varying conditions upon the Live Stock Industry will be readily recognised.

I. — THE HORSE. — In the early days of colonization the horse required was one capable of carrying his rider for long distances over all classes of country, either for a journey — 60 to 100 miles a day was lightly thought of — or for rounding up and mustering cattle in the unfenced areas of scrub and timber land or undulating plain. The qualities required for this work were stamina, speed, and agility. These were found in the English Thoroughbred and there quickly developed, in the rising generation, a love for racing and an inherent love for the horse. As time passed, and Settlement advanced, it became necessary to introduce the draught horse, crosses with the Thoroughbred were obtained and the light horse industry divided into two channels.

As Settlement of the country proceeded along the sea board and railways were laid down, the necessity for long journeys in these areas diminished, but the love of racing progressed. The Thoroughbred came under control

of a Stud Book and has developed along such lines until his reputation is known the world over. The other channel produced a thicker set and heavier horse from the various crossings which had taken place and a type was evolved which held its own against the product of other lands for military purposes. A large export trade in remounts was established, particularly with India. The love of racing, the extension of race meetings, and the desire of almost every owner (and nearly every boy owned at least a pony) to breed a winner for the local events now acted adversely upon the Industry. Horses not speedy enough, nor of sufficient stamina for classic events, were used on ponies and rejected remounts, and a somewhat light nondescript horse was bred which became a drug on the market and remount buyers had to travel further and further back into the country, remote from railways, to find the type required.

Of recent years more attention has been devoted to the breeding of this remount type of horse and for this the big boned thoroughbred is used. Light horse breeding, as distinct from the thoroughbred for classic races, has been pushed back into the sparsely populated interior of the country as settlement extended and the land became more valuable for other purposes. At this time the Government examination of stallions, referred to later, was introduced, and efforts were made to swing the pendulum back to remount breeding. A Conference of representatives from all parts of Australia, which recently met in Melbourne, made recommendations which are summarised below:—

That the first step to be taken was the elimination of unsuitable stallions and provision of suitable ones to stand at a reasonable fee.

That Mares suitable for breeding remounts be registered under district Committees who would advise as to matings, etc., and that fees for carrying on the work be obtained by a tax on the Totalizator.

The Conference was of opinion that in any scheme for improvement the Thoroughbred Stallion was essential and the right type should be encouraged by providing more valuable stakes to be run for. Further, that Mares not suitable for breeding horses could be profitably used for Mule breeding

Importations of Arabs and various classes of ponies have been made from time to time and all have left their representatives which have had an influence to a greater or lesser degree upon the Industry.

The future holds great possibilities. There are vast tracts of country still unused which are admirably adapted for horse breeding on an extensive scale.

**THE DRAUGHT HORSE INDUSTRY.** — During the early days of settlement horses of medium weight were found suitable for the limited amount of cultivation carried on, but as this extended it became necessary to develop a more weighty animal and many importations of the Scottish Clydesdale Stallion were made. As the export trade in wheat developed and large areas were thrown open to cultivation, weight was required to pull the 3, 4, and 5 furrow ploughs over the hundreds of acres each farmer worked and to cart the produce over bad roads to the railways. Two classes of fanciers arose, one favouring the Clydesdale, the other the heavier Shire Horse. Many importations were made but no Stud Books

were in use and the breeds became mixed and the individuality of the respective types somewhat lost.

Then a school of breeders arose who considered the horse with the weight of the Shire and the activity of the Clydesdale was the one required and an attempt was made to evolve an Australian draught horse. Prizes at the various Shows were given for draught horses, and Clydesdales and Shires competed in the same ring. This led to some confusion and resulted in an educational campaign being undertaken by the respective Governments with the object of impressing upon breeders that whilst the cross between the two breeds might be best for utility purposes, it could only be obtained by keeping the two parent types distinct and pure. Gradually the larger Agricultural Societies took the matter up and at their shows separated the two classes and the Clydesdale and Shire are now shown separately. The former is the more popular horse and Stud Books for control are now in operation in the Southern States of New South Wales and Victoria, while the system is extending to the other less settled ones.

**METHODS OF IMPROVEMENT.** — The most noteworthy method of improvement of the Industry that has been adopted by the Governments of Australia is that which is referred to as the Government Certification of Stallions. For the successful understanding of the scheme it is necessary to know that the Governments grant a subsidy to Agricultural Societies throughout the States to assist them in the holding of Annual Shows. In 1907 the State of Victoria introduced a system of issuing a Certificate to any stallion which, on being submitted to examination by a Government Veterinary Officer, was found to be free from hereditary unsoundness and to be of suitable breed, type and conformation to be approved as a sire. The following year it was decided that any Society desirous of obtaining the subsidy should arrange that no prize was to be awarded to any Stallion three year's old or over unless he held the Certificate. The scheme was readily adopted by breeders and within a few years extended to the other States of the Commonwealth. At the present time all States are in unison on this subject. The result of the examination for the past ten years, so far as the State of Victoria is concerned, is set forth in the accompanying Table.

An examination of the Table shows that the percentage rejections on account of unsoundness over the ten years have been as follows : —

1907/8,	1908/9,	1909/10,	1910/11,	1911/12,	1912/13,	1913/14,	1914/15,	1915/16,	1916/17
15.04	17.17	15.04	17.09	10.42	11.59	10.38	13.76	14.93	11.25

At first sight this does not appear encouraging, but closer investigation shows that the unsoundness in light horses and ponies is slight, while the inclusion of these classes in the totals and the varying numbers submitted makes considerable changes in the ratio of unsoundness. A far better index of the value of the examination is to take only that breed in which unsoundness is prevalent, namely the draughts, and for the past ten years the figures run :—

1907/8,	1908/9,	1909/10,	1910/11,	1911/12,	1912/13,	1913/14,	1914/15,	1915/16,	1916/17
23.82	27.33	23.52	21.57	12.13	12.03	11.0	15.5	19.67	16.49

By dividing this period into two of five years each and so eliminating the seasonal fluctuations, we see that for the 1st quinquennial period an average of 20.8 per cent. was rejected, while in the 2nd period the percentage was only 13.4 or a difference of 7.4 per cent and a decrease of 35 per cent.

When it is realized that certain horses though pronounced unsound have not been discarded from breeding operations altogether and that, therefore, many of their progeny are still coming forward, this result can only be regarded as satisfactory.

A Bill has now been drafted to provide for the registration of Stallions and it is hoped that it will shortly be placed upon the Statute Book. When the measure becomes law no person will be permitted to use a stallion for breeding purposes unless the same is registered and only those which obtain a Certificate, issued by a Government Veterinary Surgeon will be eligible for such registration. Examinations will be conducted on similar lines to those in existence at present. Parades are arranged and a Veterinary Officer is in attendance to conduct the examination. He determines two things:

1) Is the animal free from Hereditary Unsoundness, and for this purpose the following diseases are scheduled.

Bog Spavin,	Ringbone,
Bone Spavin,	Roaring,
Cataract,	Sidebone.
Chorea, "Shivering" or "Nervy",	Stringhalt.
Curb,	Thoroughpin.
Navicular disease,	Whistling.
Nasal disease (Osteo-porosis).	

2) Is the animal of suitable type. Inferior and common bred animals are refused a Certificate.

Should an owner feel aggrieved at the decision of the Veterinary Officer, he may appeal against the rejection on either ground by lodging a deposit of £ 5 (to prevent frivolous appeals) and a Certificate from a Veterinary Surgeon or three Judges of repute, according to the ground for rejection, to the effect that the decision was against the evidence. A Board of Appeal is then appointed consisting of the Chief Veterinary Officer and two practising Veterinary Surgeons, or the Chief Veterinary Officer and two Judges, according to grounds of rejection, who examine and determine the case. If the Appeal is upheld the deposit is refunded, if dismissed the deposit is forfeited.

It is a peculiar fact that our genial climate has been instrumental in no small degree in producing a loss of weight in our draught horse. The reason for this is that when weaned the majority of breeders leave the foals running on natural pasture. When a cold or wet spell of weather occurs the young animals receive a set back, whereas in a more rigorous climate it would be imperative to house the young stock and hand feed them over such periods and keep them growing all the time. By educational lectures delivered throughout the country the breeders are becoming more conversant with the necessity to eliminate this factor and feeding and housing are receiving more attention. When properly managed, it

is universally admitted that there is no finer country for horse breeding operations than Australia.

The Suffolk Punch breed is one which has a few representatives in our Northern States but is not a popular breed. There have been small importations of other breeds such as Percherons, etc., but they have not found favour nor have there been sufficient to keep the type distinct.

STATISTICS. — As indicating the growth of the Industry from the early days, the following Table showing the number of horses in one State of the Commonwealth, for which the figures are available, viz—Victoria, will be of interest.

Year	Number	Year	Number
1836 . . . . .	75	1850 . . . . .	21 219
1838 . . . . .	524	1852 . . . . .	34 021
1840 . . . . .	2 372	1854 . . . . .	27 038
1842 . . . . .	4 065	1856 . . . . .	47 832
1844 . . . . .	7 076	1858 . . . . .	68 323
1846 . . . . .	11 400	1860 . . . . .	76 536
1848 . . . . .	16 495		

Similar growth occurred in other States and from 1860 the numbers in the Commonwealth are as shown hereunder.

Year	Number	Year	Number
1860 . . . . .	431 525	1895 . . . . .	1 680 419
1865 . . . . .	566 574	1900 . . . . .	1 609 654
1870 . . . . .	716 772	1905 . . . . .	1 673 805
1875 . . . . .	835 393	1910 . . . . .	2 165 866
1880 . . . . .	1 068 402	1912 . . . . .	2 408 113
1885 . . . . .	1 143 064	1914 . . . . .	2 489 000
1890 . . . . .	1 521 588		

### Price of Horses,

Workers	£	£	
Extra Heavy Draughts . . . . .	40	to	70
Medium Draughts . . . . .	30	"	45
Delivery Cart . . . . .	20	"	35
Order " . . . . .	15	"	20
Remounts . . . . .	25	"	40
Saddle & Harness . . . . .	16	"	30
Ponies . . . . .	10	"	30

Special lines  
to higher values.

### STUD CLASSES.

*Draught Stallions.* — The price varies very considerably. Inferior classes change hands at £ 60 to £ 100, good classes at £ 300 to £ 500 which a few superior horses realize up to 1 000 guineas.

*Mares* range from £ 50 to £ 200 and higher.

*Light Horses.* — Thoroughbred Stallions suitable for use in breeding remounts range from £ 100 to £ 300, a few going to higher figures, while Mares suitable for mating vary from £ 16 to £ 30.

*Thoroughbred Mares* are of course higher with wide range of values according to breeding.

ASSES AND MULES. — The breeding of Mules has received very little attention, there being only 8 215 Asses and Mules in the Commonwealth.

EXPORTS. — The export trade in horses is one which has fluctuated considerably from 32 474 in 1901 to as low as 7 807 in 1909, the average being 13 700. The possibilities under this heading are enormous. There is space to breed sufficient to supply the world and the endurance of the Australian horse as shown in the theatre of war indicates that he is second to none. The distance of Australia from the thickly populated areas of Europe and the question of freights are the adverse factors.

SECOND PART  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

497 - **Agricultural Development of British Guiana.** — SPENCE, R. O. H., in *United Empire, The Royal Colonial Institute Journal*, Vol. IX, No. 2, pp. 61-65 + Map. London, February, 1918

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

British Guiana, the only British possession on the continent of South America, contains an area of 89 480 square miles, with a population of about 300 000, and produces the world-famous "Demerara Sugar" which might more correctly be designated "British Guiana Sugar".

The staple industry is really sugar, and the approximate area under canes at the end of 1916 was 75 000 acres; there is suitable land available to extend the cultivation of sugar to ten times or more the present area, and thus increase the export of sugar to over one million tons per annum. The essentials for such expansion and, indeed, for all development of any magnitude in connection with the Colony are 1) an increased labour supply, and 2) capital.

Rice cultivation now embraces about 50 000 acres and is capable of large expansion. Coconuts grow and yield well, as do also cocoa and coffee. Cotton was extensively grown when the colony was owned by the Dutch and in the early years of the British occupation, and with a plentiful supply of labour and fair prices could be again cultivated with profit. Para Rubber grows and yields well; its present area, about 5 000 acres, could be extended to a large extent as far as suitable and available land is concerned. Limes grow well wherever planted, and in properly selected areas could undoubtedly be grown at a profit. Bananas, plantains, and other ground provisions and fruits grow well, and with a proper system of cold storage and shipping facilities could be produced in quantities sufficiently large to admit of export.

Horses and cattle thrive on the coast lands, and the coastal and hinterland savannahs. There are 11 700 square miles of savannah lands suitable for stock rearing, but owing to the want of facilities for transport, the cat-

tle that can be raised on 6 000 square miles of this area adjoining the Rupuni and Ireng rivers cannot be brought to market in the Colony.

British Guiana produces some of the finest timbers in the world. Those that are at present most commonly exploited are Crab wood (*Carapa* sp.) (sp. g. 0.47 to 0.7); Greenheart (*Nectandra Rodioei*) (1.06), largely used in the construction of the Manchester Ship Canal and in the construction of lock gates for the Panama Canal; Wallaba (0.98); Belata or Bullet Wood (*Mimusops globosa*) (1.00); Mora (1.06); brown and yellow Silverballi (0.77 and 0.62), Lettei or snake wood (1.30); red Cedar (0.45). These woods are suitable for building purposes and the making of furniture. Wallaba and several other kinds of wood are used for fuel as a substitute for coal. The forests also abound in soft woods which are suitable for making paper pulp, yet not a single pulp-making factory exists in the Colony.

Other products are Balata, the dried latex of the Bullet tree; the exports of this gum are over 1 000 000 lbs. per annum, the bulk going to the United Kingdom; Locust gum, used in the preparation of varnishes; Tonka beans; Vanilla beans; Palm nuts of various kinds which are plentiful and could doubtless be turned to commercial value as oil producing factors; Souarri nuts, larger and finer than Brazil nuts. Plants of medicinal value also abound, of which no use whatever is now made.

#### RURAL HYGIENE

498 - The Organisation of the Rural Hygiene Service in Spain. — *Boletín de Agricultura técnica y económica*, Year IX, No. 103, pp. 612-619. Madrid, July, 1917.

The Spanish Service of Rural Hygiene Inspection ("Inspección de Sanidad del Campo") was re-organised by the Royal Decree of August 8, 1916. It is as yet too early to appreciate the results obtained, but there is no doubt that great advantages will be gained by the collaboration of the new service with other technical services of the Ministry of Agriculture. The sanitary police collaborate with the agricultural engineers in many kinds of work, particularly in the improvement of malarial districts and the rational cultivation and improvement of rice and medicinal plants. The appended table gives data on malaria obtained by the District Inspectors and compares the conditions of 1915 with those of 1913. The geographical distribution of malaria in Spain, the intensity and diffusion of the disease (there is an acute summer and autumn period), the microscopical examination of the blood of malarial patients in different rural districts, and even in small villages where the disease is rampant, have been studied with the greatest care, and the present malarial conditions in each of the 14 agricultural districts of Spain has been deduced from numerous details. It should be noted that, if the number of malarial municipal centres has increased, the number of cases of sickness and of death has decreased, in spite of the increased cost of quinine and food owing to the war. This is due to the ceaseless propaganda of the sanitary inspectors in matters of hygiene. In 1917 the General Administration of the Ministry of Agriculture, Mines and Forests took steps for the encouragement by the Agricultural Stations ("Granjas agrícolas") of the cultivation of medicinal herbs and the reafforestation of marsh lands, in order to reclaim, in part at least,



the 741 330 acres which form the principal centres of malaria in Spain at the present day.

*Malaria in Spain: Extent of Infected Districts and Loss  
Caused by this Disease.*

	1913	1915
Number of municipal centres . . . . .	9 261	9 261
Number of malarial municipal centres . . . . .	1 428	1 492
Total extent of malarial centres (1), . . . . . acres	1 089 924	754 748
Present value of malarial land . . . . . £	963 400	902 111
Approximate value of malarial land if reclaimed . . . £	6 134 626	5 014 334
Number of annual cases (2) . . . . .	233 404	209 420
Annual mortality (2) . . . . .	2 540	2 139
Annual consumption of quinine . . . . . cwt.	38.23	37.33
Value of annual consumption of quinine (3) . . . . . £	42 862	83 032
Days of work lost through malaria (15 per case) . . . .	3 515 595	3 141 300
Value of days lost (at 1s. 7d. a day) . . . . . £	293 192	249 098
Value of lives lost (at £ 198 each) . . . . . £	515 435	819 644
<i>Total annual losses to the nation through malaria (4) £</i>	<b>5 347 806</b>	<b>4 771 472</b>

(1) Not including the centres formed by badly cultivated rice fields and badly kept banks of rivers and canals. — (2) Figures for the years 1913 and 1915. — (3) Valued at 4 3/4 d a gram in 1913 and 9 1/2 d a gram in 1915. — (4) These figures represent the total of the differences between the present value of malarial land and the value such land would have if reclaimed; the value of quinine; the value of days lost; the value of lives lost.

In the budgets of 1915 and 1916, £ 29 740 were allotted to the distribution of water to rural centres. This has resulted in a considerable decrease in the number of cases of disease and death through infection by water. In Spain the water problem is usually limited to the protection and canalisation of local water, rather than to obtaining it from a distance, for most districts have a good supply of drinking water.

499 — **Public Health Studies Concerning Cheese.** — SCHROEDER, F. C. and BRETT, G. W., in the *Journal of the American Veterinary Medical Association*, Vol. LII, No. 6, pp. 674-685. Ithaca, N. Y., February, 1918.

The primary and special purposes of these studies on cheese were to determine the frequency with which it is contaminated with virulent tubercle bacilli at the time it reaches the consumer.

The number of samples of cheese in these investigations on which the tests are now complete is 256, and among these 19, or 7.42 %, were found to be infected with virulent tubercle bacilli. The bacilli in all cases were of the bovine type.

Leaving the samples of cheese of the varieties that require some time to ripen before they are marketed out of consideration, none of which were found to be contaminated with tubercle bacilli, the 194 samples of fresh cheese may be divided as follows: —

- 131 samples of cream, 18, or 13  $\frac{3}{4}$  %, infected with tubercle bacilli  
 31 samples of cottage, 1, or 3  $\frac{1}{4}$  % infected with tubercle bacilli  
 32 samples of Neufchatel, all free from infection.

These studies seem to warrant the following conclusions: —

1) that cheese of the kind which requires some time to ripen rarely if ever contains true, living, pathogenic bacteria when it is marketed and it does not seem likely that such cheese is apt to contain dangerous products of bacterial origin;

2) that cream cheese is often heavily contaminated with tubercle bacilli of the bovine type and should therefore be made either from pasteurized milk and cream or from milk and cream obtained from cows which have been proved free from tuberculosis. This pasteurization of milk would also destroy dangerous germs of the colon and septicemia groups;

3) that cottage and skim milk Neufchatel cheeses are much less frequently infected with the tubercle bacilli than cream cheese; but this should not be used as a reason for making them from raw milk.

500 — **The Digestibility and Utilization of Egg Proteins.** — BATEMAN W. G. (Sheffield Laboratory of Physiological Chemistry in Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 1, pp. 263-391, 8 Tables, Bibliography of 74 publications. Baltimore, Md., August, 1916.

By means of experiments carried out on dogs, rats, rabbits and man, the author arrived at the following conclusions:—

Raw egg-white is found to be a decidedly indigestible substance. It causes diarrhoea in dogs, rats, rabbits, and man when ingested in any large quantity. Its utilisation by the body is poor since it is used only to the extent of 50 to 70 per cent. Subjects can acquire a certain tolerance for the native protein after ingesting it for several days so that it no longer causes diarrhoea and is somewhat better utilized.

Raw egg-white can be made digestible through coagulation by heat; by precipitation with alcohol, chloroform, or ether; by incubation with dilute acids or alkalies; by partial digestion by pepsin; by conversion into alkali-metaprotein.

The indigestibility of native egg-white probably lies either in its anti-tryptic content or in its chemical constitution. Its physical texture appears to play a minor part in its behaviour. Of the individual proteins constituting egg-white, the albumin fraction appears to be the indigestible component.

The whites of the hen's egg and duck's egg act alike in causing diarrhoea and in being poorly utilized.

Egg-yolk either raw or cooked is excellently utilized. It sometimes causes digestive disturbances in dogs, apparently because of its high fat content.

A review of the literature shows that dietitians have relied, in general, upon the early observations of BEAUMONT as support for the use of raw eggs. These observations were in the main exact; but, so far as the digestibility of raw egg-white is concerned, were misinterpreted. In

current dieto-therapy raw whole eggs, raw egg-white, and albumin-water are extensively prescribed. There appears to be little in their conduct as foodstuffs, however, to warrant such faith in their nutritive value or ease of assimilation.

501 — **The Vitamine Content of Brewers' Yeast.** — SEIDELL, ATHERTON (Hygienic Laboratory, United States Public Health Service, Washington, D. C.), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 2, pp. 145-154, 4 Diagrams. Baltimore, March, 1917.

The author has studied the vitamine content of brewers' yeast as regards its efficacy for curing beriberi caused by a diet consisting exclusively of polished rice. His conclusions are given below.

In pigeons, the lack of vitamine in a diet consisting exclusively of polished rice can be exactly compensated for by daily doses of 0.5 to 1.0 cc. of the clear filtrate from autolysed brewers' yeast; doses of dried freshly-pressed yeast equivalent to about 1 cc. of autolysed yeast does not effectively replace the vitamine deficiency of a diet of polished rice.

Of 2 samples of dry yeast, one of which was autolysed before being dried and the other not, pigeons receiving the latter lost weight on a ration of polished rice much more rapidly than those receiving the former. The autolysis thus seems to have a favourable influence on the activity of the vitamine of brewers' yeast.

On the assumption that all the nitrogen contained in fullers' earth which has been shaken with autolysed yeast filtrate is derived from vitamine, the maximum quantity of the latter which can be present in the original yeast filtrate is 0.18 gm. per 100 cc.

The daily vitamine requirement of a grown pigeon is somewhat less than 1 mgm. A diet containing 0.0033 % of vitamine, given in quantities ordinarily consumed by pigeons, will supply this requirement.

## CROPS AND CULTIVATION

502 — **The Effects of Meteorological Factors on the Growth and Yield of Rice in the Vercelli District, Piedmont, Italy.** — MARCARELLI, B., in *Giornale di risicoltura*, Year VIII, No. 1, pp. 7-16. Vercelli, 1918.

AGRICULTURAL  
METEOROLOGY

At the "R. Stazione sperimentale di risicoltura" of Vercelli, Prof. MARCARELLI has, for some years, carried out a series of agricultural meteorological studies by the modern scientific method of parallel observations. His object was the determination of the critical periods of rice in relation to the various meteorological phenomena and factors of the district.

The apparatus is in a cage specially placed at 3.94 ft. above the ground (average height of a fully grown rice plant); the air, water and soil temperatures are determined simultaneously by three Richard's recording thermometers, the bulbs of which are in the air, water, and soil (at a depth of 5 cm.), respectively.

The experiments on the *temperature of the irrigation water* are of great importance in the rice fields, because the possibility of cultivating rice in a

more or less unfavourable climate depends both on the initial heat of the water and the rise in its temperature as a result of its exposure to the sun in shallow sheets over large surfaces. It is, indeed, only the influence of the specific heat of the water which can reconcile to any extent the extremes of temperature in the atmospheric layer immediately in contact with the vegetation and prevent the great changes in temperature so harmful to rice. It is also under this influence that the heat of the submerged soil is modified during the day and remains higher, thus favouring a maximum development of the roots.

According to the author's previous experiments, the factors necessary for a good rice yield are : — a total of average daily temperatures amounting to 3 500 to 4 500°C. for the period from April to the end of September ; a rainfall not exceeding 200-250 mm. ; a clear sky, expressed approximately by a total of fine and semi-cloudy days amounting to 140 to 170.

The *heat total* exceeds the other climatic factors in effect, but it must be regularly distributed without too frequent or excessive variations in the daily temperature. In Piedmont rice cultivation certainly does not suffer from the maximum temperature limit, for it is favoured by very hot seasons, but the minimum limit of resistance to low temperature is of great importance because of the phenomena connected with it during the various stages of the plant's development :— imperfect germination, yellowing of the young plants, limited stooling, non-setting, delayed ripening, etc.

The period in which rice is most sensitive to the air temperature coincides with the stooling stage. Although it is not exactly known if the marked need of the plant for heat at this period is due to the process of stooling itself or to the development of secondary rootlets, there is no doubt that if the meteorological conditions are unfavourable at this stage the rootlets develop slowly and do not take a firm hold in the soil, so that the development of the plant is weak, causing it to succumb to the slightest disturbance, and lodge when ripe.

Temperature also has a marked influence on the flowering stage and the setting of the grain, which are more affected by the frequency and intensity of cold nights than by the normal average daily temperatures. Frequent low early morning temperatures during the last period of the development of rice are nearly always the cause of the failure suffered in the cultivation of late rice in the Vercelli district.

The *clearness of the sky* follows immediately on the "heat" factor in the importance of its effects, especially on the quality of the product, and, within certain limits, abundant light may compensate for slight deficiencies in heat, as rice, by reason of its origin, demands sunny days.

*Rain* is harmful because it produces disturbances in the temperature round the rice field and decreases the clearness of the sky. Excessive moisture in September and October stimulates the development of the grain, causing it to germinate in the drying sheds and sometimes even in the ear in the sheaves. This explains why the summer of 1917, whose severe and prolonged drought was detrimental to the production of all other cereals, was so extremely favourable to rice. The low temperatures, the negative

action of which on the vegetative growth and maturation of the plant has already been mentioned, remained within the limits of 10 to 17°C. for the air, 18 to 21°C. for the water, and 18 to 25°C. for the soil, so that the most important biological phenomena of rice, such as stooling, flowering, setting of grain, were in every case favoured by excellent temperature conditions, and gave most satisfactory results.

As a result of the great stability in the distribution of the climatic factors in 1917 for all varieties of cultivated rice (except "Bertone", subject to "brusone" [scorching]), the critical phases of development, the period of which varied according to the earliness of the rice and the date of sowing, always coincided with favourable meteorological conditions, which caused a luxurious growth and a grain harvest as good as it was abundant.

### 503 - Plants Resistant to Adverse Meteorological Conditions Obtained by Selection.

— See No. 519 of this Review.

### 504 - New Experiments in Dry Farming in Italy — DE ANGELIS D'OSSAT, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. LI, Pt. 1-2, pp. 41-55 + 1 Diagram + 1 Fig + 6 Tables. Modena, 1918. (Author's abstract, in Italian).

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

The author, professor at the "R. Istituto Superiore Agrario" at Perugia, carried out his previous field experiments on dry farming at the farm of this Institute (1). The characters of the soil were investigated by determining: — 1) its formation; 2) its lithological nature; 3) its mechanical constitution; 4) its chemical composition; 5) its physical behaviour.

The experiment field contained two adjacent plots; the soil of one was left hard, the surface of the other was frequently worked to a depth of from  $\frac{3}{4}$  to 1 inch. The soil samples for the various determinations were taken from a depth of 8 to 12 inches.

A table gives the data obtained from May 11 to August 3, 1917, for the weight and volume of moisture in the unturned and turned soil and also the atmospheric precipitation, daily moisture and air temperature.

The second part of the experiment (from June 27) gave positive results: — the average volume of the moisture in the turned soil was 13.095 %, but only 9.385 % in the unturned soil. The maximum, minimum and average differences were 7.45 %, 1.30 %, 3.71 % respectively.

From these results it may be concluded that:

1) In superficially turned soils (dry-farmed) the moisture content exceeds that of unturned soils.

2) to prevent damage by drought the soil should, therefore, be prepared in two ways: — a) during the rainy season it should be prepared so as to allow the water to penetrate as much as possible; b) during drought evaporation should be prevented as much as possible by dry-farming.

By means of a special apparatus the author attempted to determine the relative capacity of clay and sand to raise underground water during surface evaporation. Although this experiment, made in the laboratory, is of no real practical value it has given interesting results. For a distance

(1) See R. Feb., 1917, No. 119. (Ed.).

of 8 ½ inches between the evaporating surface and the water table, clay evaporated 265.7 cubic yards of water per acre monthly, and sand 234.6 cubic yards, or 31.1 cubic yards less.

**505—A Correlation Between Bacterial Activity and Lime Requirement of Soils.** — BEAR, F. E. (Department of Agricultural Chemistry and Soils, Ohio State University), in *Soil Science*, Vol. IV, No. 6, pp. 433-462 + 3 Figs, Bibliography of 14 publications. Baltimore, December, 1917

The fertility of limestone regions is well known. It is also known that soils lacking in carbonate of lime are made more productive by liming. Alfalfa, clover and maize are the plants which do best in lime soils. Many workers have, however, noted that certain plants flourish in non-calcareous soils, and are even injured by applications of lime. Strawberries, potatoes, rye, oats, millet, buckwheat, carrots, turnips, cowpeas, crimson clover, soy beans, serradella and lupins, are adapted to acid soils. These facts suggested to the author the possibility of a system of acid agriculture, *i. e.*, in acid soils, in districts some distance from a lime supply. In the first place he studied the relation between the activities of soil bacteria and nitrogen accumulation and transformation, and the nitrogen requirement of certain soils containing from 0 to 2300 parts of calcium carbonate per 1 million parts of soil. To various portions of this soil were added gradually from 0.01 to 2 % of calcium carbonate.

The results obtained from these experiments show that the various groups of soil organisms respond differently to applications of lime. Ammonification is fairly satisfactory in most soils, even without the addition of lime, but, as a rule, the addition of moderate amounts of lime increases the rate of ammonification, and small applications are relatively more efficacious than large ones.

On the other hand, the rate of nitrification is directly correlated with the amount of lime added; excessive applications are not injurious to the nitrifying bacteria, and soils with a high lime requirement show practically no nitrification until calcium carbonate has been mixed with them.

Nitrogen fixation by non-symbiotic soil organisms is also considerably increased by liming, but the addition of mono-calcium phosphate is necessary for maximum nitrogen fixation.

Pot experiments with soy beans showed that a lime requirement of 1500 parts of lime per 1 million parts of soil was not sufficient to prevent good growth of soy beans in a soil well fertilized with acid phosphate or manure.

**CONCLUSIONS:** — 1) Plants which are able to utilise ammonia nitrogen do not suffer from nitrogen hunger when grown on soils having lime requirements not exceeding those studied in the investigations.

2) Plants which derive their nitrogen from nitrates may suffer from the lack of available nitrogen in soils having a high lime requirement unless this requirement has been at least partially satisfied.

3) The supply of nitrogen in acid soils may be maintained by growing acid-resistant legumes, of which the soy bean is one. There is no doubt that acid phosphate aids nitrogen fixation in acid soils.

4) As a rule, small applications of calcium carbonate are relatively more effective than large applications for increasing bacterial activity in acid soils.

506 - **Drainage Ditching of Irrigated Lands in Colorado, U. S. A.** - *Engineering News Record*, Vol. CXXX, No. 6, p. 263, 2 Figs. New York, February 7, 1918.

The San Luis valley, Colorado, is level and without rivers or ravines to afford natural drainage for the water coming from higher levels. Beneath the gravelly subsoil there is water under pressure, and nearly every ranch has a flowing well, many of which run continuously, causing an additional amount of surface water. Under these conditions the land in the valley has become waterlogged and therefore requires drainage.

The drainage work is being done by the CHARLES & GIBSON Co. of Alamosa, Colorado, which owns large tracts of the land and develops them for settlement.

The drainage ditches, of which over 100 miles have already been excavated, are made by 3 AUSTIN excavators. The ditches are 8 ft. wide on the bottom, with slopes of 1 on 1 1/2. They are mainly 6 to 8 ft. deep; but the machines can cut to a depth of 11 ft.

The excavated material is deposited on both sides of the cut, leaving 8-ft. banks, so that in the future a machine can be run over the ditch for the purpose of cleaning and reshaping it. The machine works night and day (except Sundays), being equipped with an electric plant for lighting. The day shift consists of 5 and the night shift of 4 men. The machine can excavate 800 to 1000 cu. yd. per 10-hour shift.

507 - **Irrigation of Alfalfa in the United States.** - I. BECKETT, S. H. and ROBERTSON, R. D., in the *College of Agriculture, Agricultural Experiment Station, Bulletin* No. 280, pp. 273-294 + 2 Figs. + 4 Tables. Berkeley, California, May, 1917. - II. FORTIER, SAMUEL, in the *U. S. Department of Agriculture, Farmers' Bulletin* No. 865, pp. 40 + 36 Figs. + Tables. Washington, December, 1917.

I. - Experiments carried out during six years at the Farm of the University of California at Davis, and observations made during one or two years on 54 alfalfa-growing farms in the Sacramento Valley, California, yielded the following data with respect to the irrigation of alfalfa in this district: -

Soil	Depth of water required to produce good yields per annum. inches	Depth of water required per irrigation, depending on depth of soil. inches	Number of irrigations per season.	Size of border strip checks		Suitable grade. inches per 100 feet	Size of irrigating head per second, per check cu. ft.
				width feet	length feet		
Medium loam.	30-36	6-9	3-5	30-50	300-600	3-6	2-10
Very gravelly or sandy . . . .	48-60	3-4	2-3 per cutting	1 00	1 00	—	5-6
Heavy . . . .	30-36	2-4	2-3 per cutting	30-50	300-600	1-3	1-4

PERMANENT  
IMPROVEMENT,  
DRAINAGE  
AND  
IRRIGATION

The experiments, the results of which are given in the above table, aimed at determining:— 1) the amount of water necessary to produce good yields of alfalfa in the light and heavy soils of the Sacramento Valley; 2) the amount of water required for irrigation; 3) the most suitable heads; 4) the soil moisture required to prevent wilting; 5) the amount of water necessary to assure the best growth of alfalfa. These experiments are described in the bulletin under review which itself is but a summary of a more complete description of the investigations.

II. — *The Farmers' Bulletin No. 865* on the irrigation of alfalfa in the United States is a revised edition of *Bulletin No 373*, published in 1909. The various methods of irrigating lucerne are described, together with the methods of preparing the soil. A description is given of the different types of levellers and other apparatus for constructing the dikes, as well as information necessary for constructing the canals, ditches, gates, and outlet valves. In the United States 95 % of the alfalfa fields are subjected to surface irrigation, the other 5 % to sub-irrigation. Near the towns of St. Anthony and Sugar City, Idaho, where the soil is composed of sand and gravel, 60 000 acres are irrigated from below.

The amount of water to be applied to alfalfa in the various districts of the United States is set out in tables. On account of the rapidity of its growth and the number of cuttings during a season, alfalfa requires more water than other crops. This sometimes leads to the use of too much water, which should be avoided. No fixed dates for irrigating alfalfa can be given; the appearance, and, more especially the colour of the plant, are the best indications of its need of water.

#### MANURES AND MANURING

508 -- **The Progress of the Nitrogen Industry.** -- BERTRAND, A., in *Anexo al Boletín de Mayo de la Asociación Salitrera de Propaganda*, pp XXXVIII + 363 Valparaíso, 1917.

Review of publications relating to the nitrogen industry in the chief producing countries, especially during the war. There are 5 parts, dealing with Germany, Chile, United States, France, Great Britain. In 11 appendices are given: — a paper by the Badische Anilin- und Sodafabrik on the monopoly of nitrogen in Germany; a study by P. FÄRENBERG, professor of Agricultural Chemistry at the University of Göttingen, on the organisation of this monopoly; the nitrogen question at the United States Congress; a list of publications on the net cost of nitrate of soda; a list of the members of the Nitrate of Soda Council since its foundation; a list of information regarding propaganda for nitrate of soda in various countries; a list of articles published in Chilean periodicals from 1907-1914 on the efficaciousness of the propaganda for nitrate of soda; a list of articles published in the above-mentioned periodicals on synthetic nitrogen products; a bibliography of the Chilean press relating to the organisation of the nitrate industry; a list of studies, projects and inventions relating to that industry; a general bibliography of the names of authors arranged in alphabetical order.

It constitutes a very full compilation of information relating to the production of nitrogenous fertilisers and their application.



The author shows that in Chili there is a lack of a publication giving nitrate of soda statistics in full and giving information as regards the production, consumption, price, etc., of other nitrogenous products. He finds that that want has been provided for:—

1) by the monograph on the "Production and Consumption of Chemical Manures in the World", published by the International Institute of Agriculture in 1914, followed by a second edition in the same year;

2) by the half-yearly publications on the "International Trade in Fertilisers and Chemical Products useful to Agriculture", commenced in September 1914, and based on the above monograph, by the Bureau of Agricultural Intelligence of the above-mentioned Institute;

3) by Part IX of the Yearbook of Agricultural Statistics, also published by the International Institute of Agriculture, which gives data regarding the production, trade and prices of chemical fertilisers for the preceding 10 years.

The author hopes that these publications will be distributed as widely as possible in Chili, and that they will lead to treating nitrate of soda statistics in the same way as others, especially if the review of "International Trade in Chemical Fertilisers" is published quarterly and then, as soon as possible, monthly.

The author considers that the war has shown that combined nitrogen is the elementary chemical basis of explosives as well as feeding and textile stuffs, so that the importance of a country can very well be measured, whether in peace or in war, by considering its capacity for producing combined nitrogen.

509 — **Spanish Mineral Products Employed in Agriculture.** — NAVARRO, B., in *Iberica*, Year V, No. 216, pp. 121-124. Tortosa, February 23, 1918.

Of the various mineral products of Spain the following are of value in agriculture, either for their use in the manufacture of fertilisers, or in the control of insects and disease:—

**PHOSPHORITES.** — These are obtained in the province of Cáceres, where there are four mines the total yield of which in 1916 amounted to 14 200 metric tons, giving an average of 50 % phosphoric acid, valued at about £ 10 000.

There are 14 superphosphate factories: — 3 at Barcelona, 1 at Cáceres, 1 at Huelva, 1 at Seville, 1 at Córdoba, 2 at Málaga, 1 at Murcia, 1 at Navarre, 1 in the Asturias, at 2 at Valencia. The total production of superphosphates rose, in 1916, to 315 180 metric tons, valued at £ 1 389 000 (1).

**AMMONIUM SULPHATE.** — There are 17 factories at Barcelona and others at Oviedo, which, by distilling coal, produce 2 720 metric tons of ammonium sulphate. The figures quoted are for 1916; those for 1917 are believed to be much higher.

(1) The superphosphates are chiefly produced from imported phosphates. Cf. *Intern. Inst. of Agriculture, The International Trade in Fertilisers and Chemical Products Employed in Agriculture* (Half-yearly review). (Ed.)

**SULPHUR.** — Sulphur-containing material ("tierras azufrosas") is obtained from a number of deposits:— 1 at Alicante, 2 at Almería, 5 at Murcia and 2 at Teruel. The total yield in 1916 amounted to 47 000 tons, with an average sulphur content varying from 12 to 25 % (Almería). The amount of sulphur obtained from raw material was 11 000 tons, worth about £ 109 000. This production is believed to have made Spain independent of imports.

**COPPER SULPHATE.** — Until recently this was not produced in Spain in spite of the many deposits of copper-containing minerals. In 1916 two factories at Barcelona and one at Córdoba produced a total of 7 600 tons, valued at £ 400 400.

**510—Fertilizers in Australia.** — in *Commonwealth of Australia, Advisory Council of Science and Industry, Report of Executive Committee for the Year 1916-17*, pp. 32-34. Melbourne, 1917 (1).

Australia is largely dependent on outside sources for the raw material of artificial fertilizers and the Executive Committee of the Advisory Council of Science and Industry appointed in 1916 by the Governor-General has devoted much attention to the consideration of possible local sources of phosphates, potash, and nitrogenous fertilizers with a view to reduce this dependence of Australian agriculture on foreign countries.

**Potash.** — Of most pressing importance is the need for developing local sources of potash, since Australia, in common with the rest of the world, was before the war dependent on the potash deposits of Stassfurt, Germany, for her supply of this chemical. Besides the use of potash for fertilizers, it is required in various secondary industries, such as the manufacture of soap, cyanides, explosives, and fireworks. The problem is not peculiar to Australia, and the Committee have obtained reports and other information as to the inquiries into new sources of potash which have been conducted in the United Kingdom and the United States of America. The sources of potash which have been suggested are a) alunite; b) kelp; c) suint; d) molasses; e) wood-ashes; f) ground igneous rocks; g) saline deposits.

a) Alunite is a mineral consisting of the sulphates of potassium and aluminium, of which there is a very large deposit at Bullahdelah, in New South Wales, and smaller though purer deposits in South Australia. The Bullahdelah deposit was formerly mined and shipped to England for the manufacture of alum, but this industry is now at a standstill. A special Committee was appointed to consider the best means for utilizing alunite, for which the Australian deposits are the most extensive in the world, specially with a view to ascertaining the best treatment for the extraction of the potash. This Committee has almost reached a stage when it can definitely state that no serious technical difficulties stand in the way of any one desirous of producing sulphate of potash and alumina from Australian alunite, but having regard to the nature of the operations involved the manufacture of sulphate of potash could be carried on with profit if done on sufficiently large scale by means of modern appliances, always provided that a local market for the output of the plant could be obtained; in other words the difficulties, if any, in the way of developing the alunite industry are economic rather than technical.

(1) See INT. INST OF AGR., *Production et consommation des engrais chimiques dans le monde*, II ed., 1914, and the half-yearly reviews *The International Movement of Fertilizers and Chemical Products Useful to Agriculture*. (Ed.)

b) The large brown seaweeds known as kelp contain a considerable quantity of potash, but species from different localities vary considerably in their content, and few investigations appear to have been made as to the composition of Australian seaweeds.

From press reports it appears that a small plant for treating kelp has been established in Tasmania, and is producing potassium chloride. The Committee are making further inquiries on this subject.

c) Suint, or wool-grease, contains a certain amount of potash, and if the whole Australian wool clip were scoured in Australia and the potash extracted, this would probably suffice for local needs. The recovery of potash in wool-scouring must be considered in connexion with the production of lanoline.

d) The recovery of potash from molasses has been considered by a sub-committee of the Queensland State Committee appointed to review the possible means of utilizing molasses. They had before them details of a proposed method, which had been brought before the Executive Committee, for absorbing the molasses with megass, producing charcoal and gas therefrom, and then burning the charcoal to an ash from which the potash could be recovered. They reported that all methods hitherto tried for recovery of potash from molasses have led to only small proportions being finally recovered, and that the prospect of burning to ash with megass did not appear at all promising, even in war-time.

e) The extraction of potash from the wood ashes of saw-mills and of eucalyptus distillation plants has been suggested, and the Executive Committee has collected evidence on the subject which points to the conclusion that the amount of potash is too small to render this a commercially profitable source. It is understood that experiments are being conducted as to the feasibility of extracting the potash from the ash left when prickly pear is burnt.

f) The utilisation of ground igneous rocks as potash fertilizers has often been discussed, particularly in the United States. These discussions have related chiefly to orthoclase feldspars or orthoclase-bearing rocks, but it was suggested to the Committee that leucite-bearing rocks might be more suitable from this point of view. The subject was referred to the Chemical Committee, which came to the conclusion that these rocks were unlikely to be able to compete with alunite as a source of potash.

g) The most satisfactory solution of the potash difficulty would be the discovery of a saline deposit in Australia rich in potash salts. It seems not improbable that such a deposit might exist in some of the lake basins of Central Australia, and it is worth consideration whether an investigation of the deposits in the beds of the salt-lakes of the Commonwealth should be undertaken.

*Phosphates.*—The possibility of increasing the local supply of phosphatic fertilizers depends on either a) the discovery locally of rock phosphates suitable for the manufacture of superphosphates, or b) the discovery of means whereby the phosphates of iron and aluminium, of which there are considerable deposits in Australia, can be made available as sources of phosphorus to crops.

The Executive Committee has made inquiries in all the States as to the likelihood of discoveries of rock phosphates, but the replies received are not very encouraging. Islands off the coast of North-western Australia and Queensland are regarded as the most probable localities to search, and prospecting in these localities should be encouraged. The known deposits of calcium phosphate on the mainland are small. Experiments as to the fertilizer value of iron and aluminium phosphates under different conditions are in progress in Victoria and Western Australia, and the Committee is considering the appointment of a Special Committee to co-ordinate these researches.

*Nitrates.* — The question of the production of nitrates from atmospheric nitrogen has also been considered. The utilization of atmospheric nitrogen, to be commercially successful, depends on the presence of a cheap source of power, and it seems possible that ultimately the Tasmanian hydro-electric scheme may be utilized for this purpose. Three different processes are at present in operation in other countries, but under present conditions it is impossible to obtain evidence as to which of these should be established in Australia, and it is certain that an expert familiar with them would need to be employed in the establishment of plant for the purpose in Australia. The Committee have come to the conclusion that, as there is no immediate prospect of Australia being cut off from the supply of Chili saltpetre, the matter should be left until the conclusion of the war.

511 — **Manganese Sulphate as a Catalytic Fertiliser for Sugar Beets.** — See No. 529 of this *Review*

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

512 — **Cyanogenesis in Plants. Studies on *Tridens flavus* (Tall Red Top).** — VIEHOEGER, A., JOHNS CARL O and ALSBREG, CARL L. (Bureau of Chemistry, United States Department of Agriculture, Washington), in *The Journal of Biological Chemistry*, Vol. XXV, No. 1, pp. 111-149. Bibliography of 7 publications. Baltimore, Md. May, 1916

The authors confirm the presence of notable quantities of hydrocyanic acid in *Tridens flavus*, a common grass widely distributed in the United States, occurring from Massachusetts to Kansas and south to Texas. The whole plant, including the roots, collected in August and examined without drying yielded 0.0075 per cent. of hydrocyanic acid. These plants after drying in desiccated air at 50°C. retained 0.0066 per cent. of hydrocyanic acid, and this quantity still remained after the dried plant had been ground and left exposed to the laboratory atmosphere for 3 months. The August plants dried for more than a month at 0°C. gave the following distribution of the hydrocyanic acid: — inflorescence tops stripped of flowers, 0.0037 %; stems, 0.0030 %; green leaves, 0.0017 %, dead yellow leaves, 0.0000; root, trace. Thus the maximum quantity of hydrocyanic acid was found in the inflorescence tops. The ripe seed did not contain hydrocyanic acid. Only a trace of hydrocyanic acid was found in plants collected in September, and none in October plants.

No free hydrocyanic acid was obtained by direct distillation with steam; by maceration with water, and subsequent distillation with acid, less hydrocyanic acid was obtained than by direct distillation with acid. Distillation of the macerated or unmacerated plant without the addition of acid resulted in a partial or complete loss of the available hydrocyanic acid.

The quantity of hydrocyanic acid obtained from *Tridens flavus* was not increased by macerating with emulsin.

When the plant was macerated in water containing a known weight of potassium cyanide, considerable loss of potassium cyanide resulted. If tartaric acid was present during the maceration of the plant with potassium cyanide, all the latter could be recovered; when sodium hydroxide was

present the loss of potassium cyanide was complete. The loss of cyanide during maceration is probably due to a chemical reaction.

*Tridens flavus* contains an enzyme which hydrolyses amygdalin.

513 — **Researches on Carotin and Its Possible Toxicity.** — See No. 542 of this *Review*.

514 — **The Origin of the Resins in the Pine.** — DUFRENOY, J., in the *Revue générale des Sciences*, Year XXIX, No. 1, p. 3. Paris, January 15, 1918.

The origin of resins in plants may be explained either histologically or cytologically, according to whether they are the transformation products of the cell membranes or of the cell contents or reserves (leucites).

Lignified membranes may become resinous; in such a case they give the reactions for pectic membranes; they can fix metallic bases and are stained orange with safranin (which stains lignin cherry-red).

In the bacterial tumours of *Pinus maritimus* the contents of the tumour become resinous.

In the needles of *Pinus maritimus* attacked by rust (*Peridermium*) the resin proceeds directly from the secretion or transformation of the chloroplasts. In unfixed sections stained directly by Soudan III in glycerine, the resinous globules can be seen forming and growing in contact with the chlorophyll grains; several globules may unite into one while the various chloroplasts that took part in their formation remain in the periphery of the globules.

In a healthy needle, the oleo-resinous globules are also less abundant in the chlorophyll-free perisperm than in the green parenchyma.

The secretion of resin is thus a very complex phenomenon, and the process of formation varies greatly according to the case under consideration; but it is never formed by the *secreting* canals, which are probably only collecting organs.

515 — **The Effect of One Growing Plant on Another.** — RUSSELL, E. J., in *The Gardeners' Chronicle*, Vol. LXIII, No. 1621, pp. 23-24. London, Jan. 19, 1918.

From time immemorial gardeners have been convinced that certain plants injure others, and, in many cases, it is firmly believed that the harmful effect remains in the soil for months, if not for years. This has led to the opinion that certain plants excrete something from their roots which is poisonous to other plants of the same kind, though not necessarily so to those of a different kind. For a long time the plant was considered as completely analogous to the animal, and, thus, the scientist agreed with the practical man in admitting the existence of a poisonous excretion in plants. Of recent years, however, much doubt has been thrown on the idea of a poisonous excretion, and serious obstacles have been shown to hinder its acceptance. In a good grass field, for example, the plants are as crowded as they can be, yet they show no signs of "sickness" or poisoning. If the soil be poor the plants may go hungry, but this may be remedied by applying suitable fertilisers; there is nothing in the appearance of the plants to suggest that any other factor is concerned.

On the other hand, some years ago Dr. WHITNEY, chief of the Bureau of Soils of the U. S. Department of Agriculture, expressed the opinion that

plants do excrete a toxic substance which may, however, be precipitated or rendered inactive by fertilisers. Therefore the improvement of plants by fertilisers is due, not only to the food they supply, but also to the above-mentioned action, and perhaps to others as well. WHITNEY'S hypothesis gave rise to much discussion, which led to a great deal of progress being made on the subject.

British investigators have usually taken the view that there is no evidence of a persistent toxic excretion. The experiments at Rothamsted seem to bear this out. At the present time the famous Broadbalk field is carrying its 75th. successive crop of wheat, and the plants look as well as any on the farm, and better than a good deal of the wheat in the district. The last crop of mangolds was the 42nd. ; it was well above the average and has rarely been exceeded during the whole period. Similarly, barley has been grown for 57 years in succession without showing any signs of suffering. Leguminous crops, however, cannot be grown in this way, and, after a short period, fail; they are the only crops which experimental evidence has shown cannot be grown year after year on the same land. Observations show, nevertheless, that other plants also fail in the same way; thus foxglove grows splendidly in the soil of a freshly cleared wood (provided the soil is suitable, e. g., the clay patches on the Downs) but for one year only, not longer. It is also said that flax and onions may fail if grown too often in the same soil. These, however, are all simply observations which, even if exact, may have some other explanation.

The idea that plants excrete poisonous substances has been investigated by Mr. SPENCER PICKERING. The growth of plants was found to be considerably decreased if they received water which had washed part of the roots of another growing plant. This effect seems to be general; the washings from the roots of mustard check the growth of mustard; those from grass check the growth of fruit trees, and so on. It was possible to establish the important point that these washings lose their poisonous quality very rapidly, so that they do not necessarily affect the soil after plant growth has ceased. These experiments are, therefore, perfectly consistent with those of Rothamsted described above.

Another set of Rothamsted experiments is, however, more difficult to reconcile with Mr. PICKERING'S results. Dr. WINIFRED BRENCHEY grew wheat alone, weeds alone, and wheat mixed with weeds. She observed that when poppy (*Papaver Rhoeas*), black bent (*Alopecurus agrestis*) and spurry (*Spergula arvensis*) were grown with wheat they made less growth than when grown alone; on the other hand, wheat made more growth per individual plant (1). This, of course, does not mean that wheat should always be grown with weeds; the plants would have done better had no weeds been present, but they suffered less from the presence of the weeds than they would have done from an equal number of wheat plants. In these experiments spurry proved more harmful than the other weeds because, by its straggling habit it badly checked the young wheat,

(1) This work is summarised in R. July, 1917, No. 625. (Ed.)

which never recovered properly. Charlock and wheat settle down to some sort of equilibrium as neither masters the other.

So far as could be seen, the effect was solely one of competition for food, and it made no difference to the individual wheat whether it competed with another wheat plant or a plant of a completely different order. The whole phenomenon could be explained by the supposition that the number of plants the soil can carry depends on the amount of plant food present in the soil and the amount of space available for growth; if the food and space are to be divided, each individual will get a smaller share and will, consequently, make less growth than if there were fewer plants present. At first sight these results seem difficult to reconcile with those of PICKERING's experiments, which seem to prove that a large number of plants suffer not only from starvation, but also from mutual poisoning, so that growth would be less both individually and collectively than when a smaller number is grown. The apparent disagreement may, however, be explained. In another of Mr. PICKERING's experiments plants grown in plots divided into compartments so that each individual root was kept separate from its neighbour made no better growth than did plants in undivided pots where the roots of the different plants mixed freely. Thus, the toxin produced by one individual plant does it as much harm as that produced by its neighbour. Further Mr. PICKERING found, in open soil, that the total growth was the same whatever the number of plants (within certain limits of distance apart) or, in other words, that the weights of the plants were inversely proportioned to the bulk of soil available. This is in full agreement with Dr. BRENCHLEY's results and may be explained perfectly well, without assuming the existence of a toxin, simply by the fact that the full crop-bearing capacity of the soil has been reached. If, with Mr. PICKERING, a toxin is assumed to be present, it must be supposed to be at least as harmful to the plant itself as to any other. This assumption involves possibilities which new experiments should investigate.

516 - **Action of Magnesium Salts on Wheat.** — VOELCKER, J. A. (The Woburn Experimental Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1916), in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVII, p. 260-262. London, 1916 (published in 1917).

In continuation of the experiments on the action of magnesia the author considered it desirable to study the action of magnesium compounds other than the oxide and carbonate. To this end he used the chloride and the sulphate (in the anhydrous state) in quantities equal to 0.10, 0.15, 0.20 and 0.40 % of the soil. The soil used contained 0.30 % of lime and 0.22 % of magnesia, giving, with the addition of the magnesia salts, a ratio of 1 : 0.88. The experiments were made with pot-cultures of spring wheat; growth was observed and the harvest analysed. The results obtained, as well as those from previous experiments (1), led to the following conclusions : —

(1) See B. 1915, No 900. (Ed.)

1) The action of magnesium compounds on wheat varies very greatly according to whether they are present as the oxide, carbonate, chloride, or sulphate.

2) The chloride may be used beneficially up to quantities of 0.10 % of the soil (1 ton per acre); in larger quantities it injures or totally destroys the crop.

3) Magnesium sulphate may be used safely and advantageously in quantities up to 0.40 % of the soil (say 5 tons per acre).

4) Increased nitrogen content, such as obtained in cereals by the use of magnesium oxide, is not produced by magnesium sulphate.

**517 - Action of Sodium Compounds on Wheat.** — VOELCKER, J. A. (The Woburn Experiment Station of the Royal Agricultural Society of England, Pot-Culture Experiments, 1916), in *The Journal of the Royal Agricultural Society of England*, Vol. LXXVII, pp. 262-264. London, 1916 (published in 1917).

In correlation with his work on magnesium (1) and by the same method, the author carried out experiments with pot-cultures of wheat using anhydrous sodium hydrate, carbonate, chloride and sulphate in quantities of 0.01, 0.03, 0.10, 0.15 and 0.20 % of the soil for the two first compounds and 0.10, 0.15 and 0.20 % for the last two. The hydrate was applied in solution, the other compounds in the solid state.

CONCLUSIONS. — 1) The different sodium compounds have very different effects both on the germination and the growth of the wheat.

2) The hydrate and carbonate at first retard germination, but eventually have a beneficial effect even when applied in amounts equal to 0.20 % of the soil, or 2  $\frac{1}{4}$  tons per acre. Besides an increase in grain there is also an increase in nitrogen content.

3) Sodium chloride has a beneficial effect if not used in quantities exceeding 0.10 %, i. e., 1 ton per acre, but is harmful to germination and production when used in larger quantities, and, if applied in amounts of 0.20 %, corresponding to 2  $\frac{1}{4}$  tons per acre, may destroy the plant entirely.

4) Sodium sulphate affects neither germination nor production and may be used without detriment in quantities up to 0.20 %, or 2  $\frac{1}{4}$  tons per acre.

5) Both sodium hydrate and carbonate cause "caking" of the soil; this was noticed neither with the chloride nor the sulphate. The first two compounds also darken the soil. In practical agriculture caking would doubtless prevent proper aeration of the soil and free growth of the plants.

**518 - The Toxic Action of Soluble Aluminium Salts upon the Growth of the Rice Plant.** — MIYAKE, K. (*Rudolph Spreckels Physiological Laboratory of the University of California, Berkeley*), in *The Journal of Biological Chemistry*, Vol. XXV, No. 1, pp. 23-28. Baltimore, Md., May, 1916.

The matter of soil acidity is one of the chief topics of the day among soil investigators. There has been a vast amount of investigation on the subject and it has come to be quite generally recognized in recent years that

(1) See No. 516 of this Review (Ed.)





by the addition of various kinds of salt solutions to soils, soluble acids or acid-acting salts are set free : that is, cultivated soils tend to become acid year by year as a consequence of the application of manures and fertilizers containing soluble salts, because when nitrates, chlorides, and sulphates are added to soils, the tendency is for the base to combine with the organic matter and the silicates in the soil, and for the acid radicle to combine with aluminium and to a less extent with iron. The soluble aluminium and iron salts which are formed are more or less hydrolyzed in solution, with consequent setting free of soluble acid ; that is, the presence of excess of acid in the soil. Of course the acid radicles combine with the stronger bases, such as calcium and magnesium, but the acid condition of any soil is due to the fact that it does not have a sufficient supply of the strong bases ; hence in many soils aluminium and iron necessarily supply the basic radicle. It thus happens that in many cases the apparent acidity of the extract from the soil as determined by titration with standard alkali in the presence of phenolphthalein, is found to be proportional to the amount of aluminium salts present in the solution, and evidently represents the amount of alkali required to precipitate the aluminium rather than actual free acidity. Accordingly, the addition of strong bases as calcium to the soil or treatment such as ignition which makes soil constituents less reactive, will stop or decrease the production of acid by the application of soluble salts to the soils.

From the view of soil acidity above stated, it appeared to be of interest to investigate the toxicity of soluble aluminium and iron salts and its relation to their acidity. As the soluble iron salts are generally present in negligible traces in the soil solution the author has confined his investigation to aluminium salts.

A review of the available literature shows that, although there is evidence that aluminium salts are toxic, there has been no research work done on the question of the relationship of the toxicity of aluminium salts to their acidity except one article by ABBOTT, J. B., CONNER, S. D, and SMALLEY, H. R. (*Indiana Experiment Station Bulletin* 170, p. 329, 1913) which touches on this matter.

The author employed cultures of young rice seedlings 10 mm. high in solutions of aluminium chloride in concentrations of  $\frac{N}{1000}$  to  $\frac{N}{20000}$  and of hydrochloric acid of the same concentrations for comparison, while cultures in distilled water served as a control. After 13 days the plants were measured ; their difference in development was striking. The concentration of hydrogen ions in some of the solutions of aluminium chloride was measured by the method of the gas chain. From the results the following conclusions are drawn :—

Aluminium chloride is toxic to the growth of rice seedlings even in dilute solution. This toxic effect appears in concentrations greater than  $N/7500$  ; it seems to be approximately equal to that of hydrochloric acid of the same normality ; it is not due to the hydrogen ion formed by hydrolysis of the salt in solution.

The concentration of hydrogen ions formed by the hydrolysis of aluminium chloride is less than that formed by dissociation of hydrochloric acid of the same normality. Since the chlorine ion is not toxic to the growth of rice seedlings in such dilute solution, colloidal aluminium hydroxide or unhydrolysed aluminium chloride molecules or aluminium ions may be the toxic factors.

The toxicity of soluble aluminium salts is dependent upon the amount of aluminium itself. The determination of soil acidity by titration in which the soil extract is titrated with standard alkali is a logical method of determining the amount of bases which should be added to the soil for the improvement of its infertility; because, although the titration does not indicate the true acidity of the soil, yet it does afford a measure of the bases which must be added to neutralize the free acid and decompose the aluminium salts, either or both of which may be responsible for the infertility.

PLANT  
BREEDING

519 — **The Selection of Plants Resistant to Diseases, Animal Pests and Adverse Meteorological Conditions.** — MoLz, E., in the *Zeitschrift für Pflanzenzüchtung*, Vol. V, Pt. 2, pp. 121-241. Berlin, 1917.

Amongst the individual specimens of some variety of plant liable to attack by diseases and pests, it is not uncommon to find some whose resistance surpasses not only the average resistance of the variety under consideration, but even surpasses the average resistance of varieties considered as resistant. In addition, the cross between two susceptible individuals sometimes gives progeny notable for a high resistance. This leads up to the problem of the creation of resistant types by means of individual selection and suitable crossings, and it suffices to consider the enormous expense due to the application of fungicides and insecticides to obtain an idea of the economic importance of varieties which, without any treatment, can remain free from pathogenic agents, or which, if they are attacked, do not suffer.

There are 2 forms of immunity:—

1) *Mechanical immunity*, due to the formation of differentiated corky layers around the infected part so as to isolate it completely and prevent pathogenic agents from penetrating into the body of the plant.

2) *Chemical immunity*, due to the presence of substances which repel or poison the pathogenic agent; for instance, the resistance of the African cacao tree to the attacks of the larvae of *Ephestia elutella* is due to the richness of the bark in tannic matter, which is, on the contrary, present in but small amount in the fruit of the Guatemalan and Venezuelan varieties, which are more liable to be attacked by these larvae.

In the apple the tannin is replaced by a phenol which, under the action of an oxydase, may change into a tannoid substance, and this change takes place just at the time when, owing to a wound or other cause, the fruit is particularly exposed to infection.

In the vine, varieties resistant to mildew and oidium, like *Rupestris*, *Berlandieri*, *Riparia* and their various hybrids, have leaves with sap of 4.3 to 10.3 % acidity (expressed as tartaric acid and calculated on the dry matter), whilst hybrids very sensitive to these fungi, like *Vitis vinifera*, *Gutedel* × *Berlandieri*, *Cabernet* × *Berlandieri*, *Aramon* × *Rupestris*, have

leaves with an acid content of not more than 0.5 to 2.6 %. Similarly, resistant varieties give a more acid must than susceptible ones.

The defensive action of citric acid is very feeble. In the apple, malic acid is no protection whatever against *Botrytis cinerea*, which even develops more vigorously in presence of that acid.

Generally speaking, substances which favour the development of mycelium are called "chemotaxic", such as the sugars, for example. But on the other hand they increase the plant's resistance to low temperatures.

As regards the plant's resistance to diseases and pests, chemical immunity is of the greatest importance, so much so that the plant breeder has to take into consideration the results of analyses and to know intimately the chemistry of the plant cell.

INDIVIDUAL SELECTION — may be carried out in two ways:

- 1) by isolating those individuals that are not attacked;
- 2) by isolating those plants which, although attacked by the pathogenic agent, are not severely damaged.

In any case the first selection should be made from as large a number of individuals as possible, since the special resistance of a number of them is not intrinsic and hereditary, but depends on special environmental conditions, such as more suitable soil, the exposure to light, good manuring, etc.

In order to produce varieties of vine resistant to phylloxera, cuttings from plants having shown special resistance are planted in separate groups by purelines; after 4 years, from each are taken 3 groups of cuttings which are to be planted in 3 localities having very different topographical, agro-geological and cultural conditions; those lines that give positive results in all the tests will afterwards provide the material for forming a plantation of resistant varieties.

The presence of correlations between the character "resistance to a given disease" and certain other characters will be of very great help to the plant breeder. Some examples of this are given below.

1) The spelt (*Triticum Spelta*) varieties from Turkestan and Samara, which are very subject to brown rust (*Puccinia triticina*), can be distinguished from the resistant west European types by the shape of the glume, which is not obtuse, but has a mucronate point bent inwards to form a hook.

2) According to Swedish observers, there is a positive correlation between the characters "resistance to cold" and "resistance to disease". This is specially the case with *Phleum pratense*, *Poa serotina* and *Festuca pratensis*, as far as regards resistance to *Sclerotinia trifoliorum*.

3) According to BABO and MACH, plants of *Vitis Berlandieri*, which had done well in the chalky soils of the Charente district, without showing signs of chlorosis, can be distinguished by golden-yellow, velvety leaves.

4) The hybrids *Berlandieri* × *Riparia Teleki*, whose shoots have a red, smooth and brilliant epidermis, while the tip is bronzed (not red), are the most resistant to chlorosis.

5) The colour of seeds shows correlations which are easily noted and which may be of practical use. Thus, the more the spermoderm of the seed of *Trifolium pratense* and *Lupinus hirsutus* is dark-coloured (reddish-yellow to deep red), the more the plants obtained from such seeds will be resistant to mildew.

HYBRIDISATION. — The resistance of a hybrid may surpass that of its parents. For example, the two wheats "Bore" and "Line 0728"

are affected by rust to different degrees, corresponding respectively to the figures 4 and 2. In their  $F_3$  cross, numerous forms were obtained, some of which were more resistant to rust than the more resistant parent, as is shown by the following figures:—

6 forms having a degree of resistance equal to 0									
6	»	»	»	»	»	»	»	»	1
6	»	»	»	»	»	»	»	»	2
2	»	»	»	»	»	»	»	»	3
3	»	»	»	»	»	»	»	»	4
3	»	»	»	»	»	»	»	»	5
2	»	»	»	»	»	»	»	»	6

In cases like this, the degree of resistance of the hybrid evidently corresponds to the sum of the factors present in each of the parents ( $A, B, C \times D, E, F = ABCDEF$ ). In a similar way the possibility can be shown of obtaining resistant types by crossing susceptible ones, when, in order to determine the "resistance", both groups of factors must be present simultaneously. Thus in crossing "Up to Date" and "Yellow Norwegian" potatoes, both susceptible, NILSSON obtained in the  $F_2$ , 29% of individuals having a high degree of resistance to *Phytophthora infestans*.

But as, on the other hand, it is impossible to find out what are these determining factors and what is their number, at least one parent in each crossing should have a high degree of resistance.

Excellent material for hybridisation is to be found in wild varieties, or in native varieties cultivated since time immemorial in some given locality and completely acclimatised. In time, by natural selection the weak or susceptible forms will have disappeared, leaving the progeny of the most resistant parents. In 1840 a terrible invasion of *Phytophthora infestans* destroyed the potato crop over a great part of Europe; the few surviving plants became the parents of new varieties possessing a great resistance to this disease.

By crossing wild varieties of fruit trees with cultivated forms, HANSON has obtained, in the United States, types of fruit trees showing great resistance to cold.

In this and similar cases, it is most important to use abundant material, for, in the great mass of possible combinations (given the large number of determinants), only a small number of individuals will present the desired characteristics, so that, if the observations are limited to a small progeny, it may easily happen that the desired type will not be found.

By means of selection and hybridisation followed by selection, types may be created that are specially resistant to diseases, pests and adverse weather conditions, as is shown by the results already obtained in many countries:—

1) GERMANY. — Since 1896, BEHRENS has obtained, by suitable crosses, a type of tobacco resistant to *Bacillus maculicola* Delacr., just as STRUBE was able, by selection, to increase the resistance of his spring wheat "Schlanstedter" to the attack of *Ustilago triticea*. On the other hand, ARNIAN has obtained potato varieties resistant to *Phytophthora*, and VON LOCHOW has isolated from the "Wohltmann" variety of potato, some types resistant to leaf-curl caused by *Fusarium* spp.

WANNER and RASMUSSEN are trying to obtain varieties of vine resistant to phylloxera, and H. C. MÜLLER and the author started a series of trials in 1912 in order to obtain a type of sugar-beet resistant to *Heterodera Schachtii* A. S.

UNITED STATES. — The work of several agricultural Stations is almost exclusively that of selecting plants resistant to diseases and adverse weather conditions. Thus the Pomological Station situated near Lake Minnetonka (Minnesota) has produced, by methodically carrying out a continuous series of crossings, some fruit-trees that have a great resistance to low temperatures. Very encouraging results have been obtained for apples and about a thousand of the most promising hybrids are being grown in the nursery of the Station. Further, by crossing the Japanese Burbank plum with the American Wolf plum, the same Station was able to fix the characters "resistance to cold", "early maturity", and "fine, tasty fruit" (which are almost seedless) in very good proportions in the new hybrid.

Other results that are very interesting from the scientific point of view have been obtained by crossing apricots, peaches and plums; by repeatedly crossing hybrids (plum  $\times$  apricot)  $\times$  plum with the apricot or peach, hybrids are obtained that give fruit resembling the apricot and which are very resistant.

Equally important results have been obtained with the vine in a relatively short time. The hybrids Beta  $\times$  Concord and Beta  $\times$  Brighton, with suitable selection, have given varieties with fruit having the quality of the varieties Concord and Brighton together with the vigour and resistance to cold characteristic of the Beta vine.

At the New York Agricultural Station work has been in progress for 26 years in order to improve the vine and between 1898-1903, at least 1500 hybrids were tested, only 5 being found worthy of notice. Since 1905, in the crossing and selection experiments, possibilities suggested by studying Mendelian laws have been taken into account.

Thanks to the initiative of the Massachusetts Asparagus Growers' Association, a series of experiments were started in 1906 which have helped to improve the asparagus considerably (1); some types have been obtained that are completely resistant to *Puccinia Asparagi*.

By crossing the common water-melon, susceptible to *Fusarium nivum*, with an aberrant type, resistant to that fungus, but with non-edible fruit, ORTON obtained intermediary forms in the  $F_1$ ; in the  $F_2$ , a large number of very varied combinations; in the  $F_3$  a plant which was isolated not only bore typical water-melon fruit, but also had the resistance to *Fusarium* of the aberrant parent. From this individual was isolated the Conqueror variety with excellent fruit and resistant to *Fusarium*.

On the other hand, the Iron variety of *Vigna Catjang*, resistant to *Fusarium tracheiphilum* and *Heterodera radiculicola*, was crossed with the Black and Whippoorwill varieties by ORTON, who obtained some lines uniting the resistance of Iron to the vigour and seed characters of the more valuable parents.

(1) See R., March, 1918, No. 285. (Ed.)

In the United States, types of gooseberry resistant to *Puccinia Ribis* D. C. (HANSON) have been obtained, as well as potatoes resistant to *Phytophthora infestans* and *Chrysophlyctis endobiotica*, vines resistant to blackrot (*Guignardia Bidwellii*) (HERFF) and oats resistant to *Ustilago Avenae* (NORTON).

FRANCE. — For a long time numerous crossings have been made, in accordance with a definite programme, between American and European vines in order to obtain disease resistant varieties.

According to CASTEL, the hybrids of *Vitis europaea* with *V. Labrusca* give the best results, both against mildew, oidium and blackrot. The hybrid Maurice Baco 22 A (Folle Blanche × Noah) is very productive and is resistant to *Botrytis cinerea*. As regards mildew, the following is a list of the most resistant hybrids:

*Hybrids with red grapes*: Malègue 2094-3; Malègue 2183-3; Baco 1; Jurie 580; Gaillard 194; Couderc or Coutassot 7120; Couderc 106-46; Seibel 873; Seibel 1082; Seibel 4121; Malègue 829-6.

*Hybrids with pink grapes*: Seibel 2857; Seibel 4464; Malègue 474-5.

*Hybrids with white grapes*: Seibel 793; Seibel 880; Seibel 2653; Seibel 4645; Seibel 4991; Malègue 57-1; Malègue 1157-15; Malègue 1647-8; Malègue 1897-12; Couderc 235-120; Couderc 272-60; Girerd 157.

INDIA (Pusa), AUSTRALIA, NEW ZEALAND. — In these 3 countries, varieties of wheat have been obtained that are resistant to rust, to *Tilletia laevis* Kuhn and *T. tritici* Wtr., and in New Zealand a rust-resistant oat (Ruakura Rust Resistant).

EAST INDIES. — After the terrible epidemic of *Hemileia vastatrix* the *Coffea arabica* was replaced by *Coffea liberica* resistant to the disease but giving coffee of inferior quality. By suitably crossing these two species, MANES obtained hybrids uniting the valuable qualities of both parents.

On the other hand, KOBUS obtained good results by crossing the "Tjeribon" sugarcane, very good, but not resistant to disease, with the Hindu variety "Tschun" which, however, is very resistant.

RUSSIA. — Selection for resistant types is carried out at the Saratov Agricultural Station. By crossing the sunflower cultivated in Russia with a Californian variety, STEBURT and KARSIN obtained varieties resistant to *Homœosoma nebulella* (1).

520 - Varieties of Egyptian Cotton Produced by Mutation. — KEARNEY, THOMAS H., in *The Journal of Heredity*, Vol IX, No. 2, pp. 51-61 + 8 Figs. Washington, February, 1918.

Egyptian cotton is much in demand on the American market for the manufacture of articles requiring a high degree of tensile strength, such as sewing thread, durable hosiery and motor-car tyre fabrics. At the suggestion of the U. S. Department of Agriculture, and under the direction of Dr. H. J. WEBBER numerous comparative cultural experiments were begun in 1900 at agricultural stations in the south and south-west, using cotton seed imported directly from Egypt. These experiments showed that it is possible to cultivate Egyptian cotton in the United States if it is grown on

(1) See R., April, 1917, No. 321. (Ed.).

the irrigated lands of the south-west. Nevertheless, even under the most favourable conditions the newly-imported varieties produced little, ripened late and varied greatly. This is probably due to the fact that in Egypt the cotton fields are often exposed to cross fertilisation with hybrid varieties, particularly with the "Hindi" cotton, which grows wild in the fields.

Careful selection was, therefore, required to obtain earlier, more productive, and more uniform types. Selection experiments begun at Yuma (Arizona) gave very satisfactory results in a few years, involving the improvement and gradual fixing of the desired characters without altering the structure and appearance of the original type, "Mit Afifi".

In 1908 a new era began with the unexpected appearance of two lines obtained by selection differing greatly from the parent stock and from each other. These two lines gave rise to the Yuma and Somerton varieties. The second variety had to be discarded because of its excessive production of sterile branches, but the first became the basis of the Egyptian cotton industry in Arizona. This new variety differs from the Mit Afifi variety in longer and more pointed bolls, and in a longer ( $1\frac{1}{2}$  inch) and lighter fibre.

Mr. E. W. HUDSON obtained a third variety, Gila, from a plant selected in 1908 in a field of acclimatized Mit Afifi cotton at Sacaton, Arizona. Although differing less from the original stock than the Yuma and Somerton varieties, Gila is sufficiently distinct to be considered as a new variety.

The Yuma, Somerton and Gila varieties are, thus, all derived from the Mit Afifi Egyptian cotton.

In 1910, in a field of Yuma cotton at Sacaton, a specimen was selected and kept separate because of its superior productiveness and length of fibre. From this plant was derived the Pima variety which differed from the Yuma variety in fewer vegetative branches and better developed fruiting branches, by its plumper, more sharply pointed and less deeply pitted bolls, lighter, silkier, and longer ( $1\frac{5}{8}$  to  $1\frac{3}{4}$  inch) fibre.

The new varieties spread rapidly, especially in the Salt River Valley, where they were grown over ever-increasing areas: — in 1912, Yuma, 200 acres; in 1917, Yuma, 23 000 acres, and Pima, 7 000 acres (a total of 30 000 acres); in 1918 it is estimated that the crop will cover 100 000 acres.

The Yuma and Pima varieties supply first quality material for spinning and for motor tyres. Pima is preferred on account of its earliness and long fibre, and will undoubtedly completely supersede Yuma. It is not easy to solve definitely the problem of the origin of these varieties; certain phenomena point to roguing, whereas others point rather to true mutation.

I. — ROGUING. — 1) Mit Afifi cotton probably originated towards the middle of the 19th century from hybridization of Sea Island with a brown linted African tree cotton; 2) as has been already stated, Egyptian cotton fields are frequently exposed to cross-fertilisation. Consequently the presence of many heterozygous characters would explain the frequent appearance of rogues.

II. — MUTATION. — The following phenomena, however, are in favour of the mutation hypothesis: 1) the sudden appearance and fixation of the new types; 2) the total absence of forms intermediate to the original and new types; 3) the differential characters of the new type, which are entirely

new and of which no trace is found in the species or varieties of cotton which are likely at any time to have come in contact with *Mit Affi*.

521 - **Variations in Eucalyptus Trees in Plantations; Eucalyptus Hybrids Observed Chiefly in Algeria.**— TRABUT, L. (Professor of the University of Algiers, Director of the Botanical Service of the General Government of Algeria), in *Bulletin de la Station de Recherches Forestières du Nord de l'Afrique*, Vol. I, Pt. 5, pp. 140-155 + 6 Pls. + 6 Tables, Algiers, 1917.

Eucalyptus trees were introduced into France towards 1854 and, since 1862 plantations have been made in Algeria. In 1876 a private collection, started in 1864, contained 10 000 trees belonging to 120 species, all of which did more or less well.

The author's observations and propagation experiments show that, in Algeria, the eucalyptus trees contained in collections may be crossed with the greatest ease. This is very valuable knowledge from a practical point of view because hybrid plants are stronger and better suited to the climate than the stock from which they are derived. For this reason there is no doubt that plantations should be formed with such hybrids.

After artificial hybridisation, which will give important practical and scientific results, has been carried out, the cultivation of the eucalyptus tree will become essential in the Mediterranean district, where it renders extremely valuable services.

#### AGRICULTURAL SEEDS

522 - **The Production of Forage Plant Seeds in Denmark.**— *Statistiske Entretæninger*, Year, X, No. 1, pp. 5-6. Copenhagen, January 23, 1918.

The extraordinary rise in the price of forage plant seeds has caused in Denmark a considerable increase in the area cultivated for the production of such seed; this is shown by the following figures:—

#### *Area cultivated for the production of forage plant seeds in Denmark.*

Seed	July, 1917 acres	December 5, 1917 acres
<b>Roots:—</b>		
Swede . . . . .	2 528.6	7 125.0
Turnip . . . . .	1 875.5	12 490.1
Carrot . . . . .	1 487.1	5 042.2
<b>Forage Leguminosae:</b>		
Clover, alfalfa, etc. . . . .	2 210.8	1 513.0
<b>Forage grasses:—</b>		
Cocksfoot . . . . .	18 265.6	22 502.3
Meadow fescue . . . . .	2 993.5	3 585.0
English ray-grass . . . . .	5 751.0	2 866.5
Italian ray-grass . . . . .		4 222.0
Field brome grass . . . . .	3 199.3	7 028.0
Other forage grasses . . . . .	2 012.0	1 476.5
<b>Total . . .</b>	<b>40 323.4</b>	<b>67 851.5</b>

It is seen that the increase in seed production for root crops is considerable, whereas that for grasses only forms about 30 % of the total.



523 - **The Identification of Varieties of Barley.** — HARLAN, HARRY V., in *United States Department of Agriculture, Bulletin No. 622*, 32 pp + 4 Plates, Bibliography of 41 publications. Washington, 1918.

The variations that occur in barley are of importance to the student agronomist, plant breeder, and pathologist. They offer a wide opportunity for selection, breeding, and study of disease resistance. In barley the forms are unusually numerous and clearly defined. The number and character of the types existing are more concisely indicated by a classification of variations than in any other way. The groups of barley were arranged upon the basis of species, varieties, and sub-varieties. Only major characters have been used in describing species and varieties; less important characters have been utilized in describing sub-varieties. Under each sub-variety there may be an unlimited number of agronomic varieties. Four species and 32 varieties are recognized as follows: — *Hordeum vulgare* with the varieties: *pallidum*; *nigrum*; *Horsfordianum*; *atrum*; *coeleste*; *duplicatum*; *trifurcatum*; *aethiops*; *H. intermedium* with the varieties: *Haxtoni*; *Mortoni*; *subcornutum*; *atricornutum*; *nudi-haxtoni*; *nudi-mortoni*; *cornutum*; *subaethiops*; *H. distichon* with the varieties: *palmella*; *nigricans*; *angustispicatum*; *Rimpasi*; *nudum*; *nigrinudum*; *laxum*; *nigrilaxum*; *H. deficiens* with the varieties: *deficiens Steudelii*; *tricerus*; *tridax*; *nuidedeficiens*; *decorticatedum*; *sublaxum*; *gymnospermum*.

All groups have been made to conform with previous usage as far as possible. One of the principal aims of the writer has been to state clearly the form or group intended to be described by each published name. Except for their historical significance, the sub-varieties would not have been continued, and no forms have been added to them.

Four varieties have been added.

Lists of rejected terms and varieties are included.

The keys can be adapted to the identification of thrashed grain by a number of characters. In the common agronomic varieties the chance of error in the identification of thrashed grain is slight.

524 - **Sorghums for Forage in South Dakota.** — CHAMPLIN, MANLEY and WINRIGHT, GEORGE, in *Agricultural Experiment Station, South Dakota State College of Agriculture and Mechanic Arts, Bulletin No. 174*, pp. 624-645, 9 Tables, 15 Figs. Brookings, S. Dak., March, 1917.

FORAGE CROPS  
MEADOWS  
AND PASTURE

Sorghum is commonly used for forage in South Dakota. In the United States, three fourths of the total herbage produced by all sorghums is consumed as coarse forage. The most promising forage sorghums are the black and red seeded amber canes and Sudan grass. Dwarf milo, feterita, kafir, shallu and others are also grown in some localities.

This bulletin gives the results of comparative trials of the producing power of these crops and directions for growing the crop based on the writers' experience at the South Dakota Experiment Station farms at Brookings, Cottonwood, Eureka, Highmore and Vivian. They are summarized as follows: —

Sorghum as a forage crop is worth considering carefully in South Dakota because it matures quickly, yields fairly well and is adapted to

hot weather and limited moisture conditions; it may thus be used as a catch crop. Sorghum as a forage crop is not superior to maize in seasons that are reasonably favourable to maize.

Several difficulties are encountered in growing sorghum on account of the small seed, danger of planting too deep and the slow growth of the young plants.

Variety tests of sorghums in South Dakota indicate that Sudan grass is best for hay, the amber canes for coarse fodder and dwarf milo for silage. The average yields of fodder as compared with maize in variety tests at Brookings in 1914-1916 were as follows: —

Crop	Yield in lbs. per acre
Minnesota Amber. . . . .	5 110
Sudan . . . . .	4 580
White Amber . . . . .	4 000
Freed Sorgo . . . . .	3 680
Dakota Amber . . . . .	3 680
Kaoliang. . . . .	3 300
Dwarf White Kafir. . . . .	3 220
Feterita . . . . .	2 500
Kaferita . . . . .	2 000
Brookings 13, Maize. . . . .	6 637

The soil preparation necessary for maize is sufficient for sorghum.

Where moisture is plentiful Sudan grass gives the best results drilled in 6 or 12-inch rows. It can be used as an intertilled crop if desired.

All varieties of sorghum except Sudan grass gave the best results in method of seeding tests when drilled in rows 36 or 42 inches apart and cultivated.

In date of seeding experiments Sudan grass gave best results when seeded between May 20th and June 1st. It is safe to assume that these dates are also best for the amber canes and dwarf milo, as these sorghums have practically the same temperature requirements.

Head selection should be practiced in securing sorghum seed.

Sorghum drilled in 36 or 42-inch rows may be harvested with an ordinary corn binder. Shocks must be built small.

Sorghum drilled in 6 or 12-inch rows or sown broadcast may be harvested with a mower or grain binder.

525 — *Medicago falcata*, a Yellow-Flowered Alfalfa (1). — OAKLEY R. A. and GARVER, SAMUEL, in *United States Department of Agriculture, Bulletin* No. 428, pp 70, 9 Tables, 23 Fig., Bibliography of 67 publications. Washington, 1917.

The first recorded importation of *Medicago falcata* in the United States was made in 1897. The first systematic introductions for the purpose of utilizing the species as a cultivated forage crop were made in 1906 by Prof. N. E. HANSEN under the auspices of the U. S. Department of Agriculture. Since that date many lots of seed representing various forms of the species have been introduced by Prof. HANSEN, Mr. F. N. MEYER

(1) See also R., 1917. No. 333. (Ed.)

and various others. Approximately fifty lots have been introduced, mostly from Russia and Siberia.

At the present time *Medicago falcata* is found growing without cultivation in most parts of Europe and the western two-thirds of Asia. Over a large portion of this area it is probably indigenous. It is found throughout a wide range of soil and climatic conditions and at depressions and elevations ranging from below sea level to 13 000 feet above. It is much wider in its adaptations than *Medicago sativa*.

The species was recognized by botanists early in the history of modern botany, if not long before. Recent botanists differ somewhat with regard to its taxonomic relationship to *Medicago sativa*. Some give it the rank of a true species, while others regard it as a variety or subspecies of the latter. The natural relationship of the two, however, is quite clearly shown by the readiness with which they hybridize and the fertility of their hybrids.

It is an extremely variable species, many forms of which are difficult to classify satisfactorily on account of their varying combinations of characters and the difficulty of determining whether they are of pure or hybrid origin. A classification or grouping has been attempted in this paper largely upon the basis of habit of growth. Four groups have been established, ranging in habit from prostrate to almost erect. The first two are referred to as pasture groups, as they are not sufficiently erect to be harvested satisfactorily for hay by machinery. The last two are sufficiently erect to be harvested for hay and are referred to as hay groups.

Botanists have named and described several of the species, many of which have proved to be hybrids of *Medicago falcata* and *Medicago sativa*.

*Medicago falcata* has never been extensively cultivated in Europe or Asia, although it has been utilized as a wild forage plant since a very early date. Many attempts have been made to cultivate it in Europe, but so far as can be found it is now being cultivated only in India and, possibly, to a very limited extent in south-eastern Russia and Chinese Turkestan.

The erect forms of *Medicago falcata* closely resemble those of *Medicago sativa* in their mass effect, but on an average they produce a heavier yield in comparison with their bulk, partly because of the more numerous stems and partly because of the texture of their herbage. Under similar conditions of soil and stand of plants the best strains of *Medicago falcata* frequently outyield the best varieties of *Medicago sativa* for the first cutting of the season.

A very serious drawback to the general utilization of *Medicago falcata* as a cultivated forage crop is its inability to recover quickly after cutting. Under conditions such as exist in the West and Northwest, where it appears to offer its greatest possibilities, it can be depended upon to make only one crop in a season. It produces seed sparingly and does not hold it as retentively as does *Medicago sativa*. This is also a serious handicap to its use as a cultivated crop.

The natural range of distribution of the species, its adaptations, and its behaviour under field conditions in the United States warrant the conclusion that it is relatively hardy and drought resistant.

Chemical analyses and general feeding tests indicate that it is approximately as valuable from a feeding standpoint as common alfalfa.

The cultural requirements of *Medicago falcata* appear to be much the same as those of *Medicago sativa*. On account of the hard seed which the former produces and the slow growth of the young plants it is difficult to secure a satisfactory stand from seeding, either broadcast or in rows. When grown in broadcast stands the procumbent forms are inclined to be more nearly erect than when grown in rows or hills. The plants of this species bear transplanting better than do those of *Medicago sativa*.

Data from broadcast plants of *Medicago falcata* and *Medicago sativa* indicate that in seasons when only one cutting of the latter can be procured the former produces the heavier yield, but in favourable seasons, when two or more cuttings can be procured, the latter excels appreciably in yield.

Sowings of *Medicago falcata* have been made on unbroken native sod land and a fair stand of plants secured. The plants appear to lack sufficient aggressiveness to make them really valuable under such conditions.

The greatest possibilities offered by the species appear to be in the field of selection and hybridization. In a few cases it is probable that the development of promising pure strains by selection will prove to be advantageous. As the result of hybridizing with *Medicago sativa* and subsequent selection it is believed that superior varieties of alfalfa can be developed and that the greatest value of the species is for this purpose.

Much time and effort will be required before *Medicago falcata* will be ready for general cultivation.

CROPS  
YIELDING OILS,  
DYES AND  
TANNINS

526 - Cultivation of the Castor-Oil Plant in North Africa. — COUSTON, F., in *Journal d'Agriculture pratique*, New Series, Vol. XXXI, No. 3, pp. 45-47, February 7, 1918; No. 4, pp. 71-73, February 20, 1918; No. 5, pp. 94-95, March 7, 1918. Paris.

The castor-oil plant grows abundantly in many ravines on the North African coast. The severe winters prevent its growing in the Upper Table Lands and in the Atlas Mountains, but it re-appears in the Sahara zone and is found in many oases where it was originally imported as an ornamental shrub. The author has observed it from the Biskra district (foot of the Atlas) to Ain-Salah and Aoulef, more than 600 miles further south, in the midst of the Sahara.

The castor-oil plant is perennial. It is injured by hard frosts and prolonged cold, and requires much water in summer, when its growth is most active. It would do well all along the coast, and in the south in the Sahara district, wherever it is assured of sufficient moisture during the summer growing period. In its climatic and cultural requirements it resembles cotton; *in North Africa the castor-oil plant thrives wherever the cotton-plant does well*. It seems to withstand slightly more cold than cotton.

The variety chosen should have the following characters: — abundant yield of well-filled seed; fruit ripening as much as possible at one time; in particular, *moderately dehiscent* capsules; varieties the indehiscent fruit of which require excessive threshing and husking should be rejected, as well as those the capsules of which open suddenly when ripe, often casting the seed a distance of some yards.

The Marseilles industry, consulted in 1917 by the Administration of the South Algerian Territories on the varieties most suited to the manufacture of oil, replied that the various samples of castor-oil seed received at different times from Algeria were perfectly suitable. As this industry chiefly uses seed from India, mostly from Bombay, the General Government of Algeria obtained at Marseilles, seed from Bombay (of the ordinary small castor oil plant = *Ricinus communis minor*) for free distribution. According to Dr. TRABUT, this plant is the one best suited to the dry Algerian climate from the point of view of dehiscence of the capsules.

The author then discusses the systematic cultivation of the castor-oil plant and the planting of uncultivated land moist in summer (bottom of ravines, banks of canals, irrigated gardens and oases, beds or banks of "oueds", ditches, railway embankments, etc.), and draws attention to the uses of the castor-oil plant and its by-products. Finally the necessity for establishing castor-oil factories in Algeria is pointed out.

527 - Rubber in North Borneo. — *The Tropical Agriculturist*, Vol XLIX, No. 4, pp. 197-200. Peradeniya, Ceylon, October, 1917.

RUBBER, GUM  
AND  
RESIN PLANTS,  
ETC.

The area planted with rubber at the end of 1916, according to returns received from managers of estates was 30 910 acres. Small holdings planted by Chinese and natives are not included in these figures. The amount of new land planted during the year, was only 529 acres. The number of trees in tapping at the end of the year was 2 030 150 or a little over half the total number planted, which is returned at 4 049 050. The area in full tapping was 14 720 acres as against 9 806 acres at the end of the previous year.

According to the figures supplied by the Customs Department the export in 1916 was 1937.7 tons, an increase of 84.4 per cent. on the total of 1050 tons shipped in 1915. In January the price of smoked sheet reached 4s. 2d. but dropped quickly to about 3s. 6d.; it then declined steadily until August, when it had fallen to 2s. 1 1/2d., after which it rose to about 3 s. 0d. in December.

The extension of tapping operations necessitated an increase in the labour force at most estates. At the end of the year the total number of coolies employed was 12 334, an increase of 2 698 over last year's total. Whereas in 1915 one coolie was sufficient for three acres, in 1916 the average was one for 2.5 acres. Of the coolies 5 179 were Chinese and 4 280 Javanese; 2 875 belonged to other races, all but a few being natives of North Borneo.

The rainfall in 1916 was heavier than in the previous year. Estates on the West Coast had an average of 165 inches of rain in 199 days, in the Interior 66 inches on 202 days, in the Kudat residency 89 inches on 176 days, in the Sandakan residency 133 inches on 212 days, and in the East Coast residency 95 inches on 130 days. On no estate was there a single month entirely without rain.

- SUGAR CROPS** 528 — **Chemical and Biological Researches on Sugar Beets, in Bohemia.** — URBAN, G., Über Alkalien in den Rübenpflanzen. *Zeitschrift für Zuckerindustrie in Böhmen*, Year XLI, Pt. 7, pp. 415-420. Prague, 1917. — II. STENLIK, W., Über die Wirkung von Röntgenstrahlen auf die Keimung des Rübensamens und das Wachstum der Zucker- und Futterrübe. *Ibid.*, pp. 424-427, 2 Fig. — III. URBAN, G., Über die Farbe des Rübenkrautes früh und spätreifender Rüben. — *Ibid.*, pp. 281-287, 1918. — IV. BARTOS, W., Der Einfluss der Veredlung auf den Wert der Rübe *Ibid.*, pp. 299-302.

I. — **ON THE ALKALIS IN BEETS.** — Analyses of the leaves and roots of 75 sugar-beets gathered in mid-August from the same row and derived from the same parent plant; the intention was to study the potash and soda content. This, as with the sugar and nitrogen content, and other characters, shows variations both for the roots and the aerial part of the plant. Such fluctuations are even found in the progeny from a single parent-beet. The following summary of the data obtained illustrate this point.

	Minimum	Maximum	Average
Potash content of roots . . . . .	0.135 %	0.301 %	0.218 %
Soda " " " . . . . .	0.018	0.150	0.0508
Potash content of leaves (calculated as dry matter) .	1.35	3.13	2.14
Soda " " " ( " " " ) .	5.88	12.33	7.54

It was found that the corresponding beets were poorer in sugar as the soda content of the roots and, consequently, that of the whole plant, was higher in relation to the potash; but this relation, found in the average of an important series of analyses of beets, is not always present in the case of a single beet.

II. — **ACTION OF RADIUM ON BEET SEED.** — The seeds of cereals, leguminous plants and beets were treated with Röntgen rays at the Beet Seed Selection Station at Samčic near Dobrovic. Both for sugar beet and mangold seeds treated by Röntgen rays, nothing special was noted when they had germinated; but later on, when the first leaves were formed, the young plants obtained from seeds exposed for 1-2-3 minutes to Röntgen rays, clearly showed a difference in development in comparison with the plants obtained from untreated seeds. This difference in development was maintained in the following stages: young plants exposed to the rays for 2 minutes developed better, while those exposed for 7 minutes showed signs of atrophy.

In short, moderate action of Röntgen rays on beet seed has a favourable effect on the growth of the plant; but more intense action is harmful. It still remains to be ascertained whether the rapid growth of the young beet plants, caused by a moderate action of the rays, does not result, by reaction, in fatigue and weakness during the ultimate phases of vegetative growth. Two minutes was found to be the best exposure for mangolds.

III. — **COLOUR OF BEET FOLIAGE.** — The more or less intense colour of beet leaves depends on the degree of maturity and the content in food material, depending in turn on the nature of the manuring and on the soil

moisture ; again, the colour shade of the foliage is a type character of the different varieties of beet.

It appears to result from a series of observations and determinations carried out over several years on 2 descendants of sugar beets, one with light-coloured leaves, the other with dark leaves, the other conditions (soil, manuring, etc.) remaining the same, that a dark green leaf contains more nitrogen than a light green leaf, so that there would be a direct relation between the colour of the leaves and the corresponding nitrogen content. On the other hand, light-coloured foliage does not always indicate early maturity or a high sugar content in the roots ; there may be beets with light coloured leaves that are early and richer in sugar, but the contrary may also happen. In experiments lasting 2 years, the progeny with dark leaves yielded better and produced more sugar than the light-leaved ones ; they form sugar very rapidly in late autumn.

In 1 year experiments, analysis showed that the darkest leaves contained more potash and less soda, but this observation, based on one case only, can not be applied generally. It seems rather that there is a certain relation between the highest potash content of the leaves and the greatest sugar content of the roots. Both in beets with light coloured foliage and those with dark leaves, the potash rapidly increases in the leaves, while the soda content decreases as the beets mature.

IV. — INFLUENCE OF SELECTION ON THE VALUE OF BEETS. — The analytical data collected each year by the various Czech Sugar Associations give an idea of the averages for 20 years as regards Bohemia : —

Periods	Sugar Content	Weight per beet, in gm			Percentage of foliage in relation to the root
		Root	Sugar	Foliage	
1897-1901 . . . . .	14.88 %	354	52	244	69 %
1902-1906 . . . . .	16.4 »	355	58	239	67 »
1907-1911 . . . . .	16.8 »	374	63	268	72 »
1912-1916 . . . . .	17.6 »	467	82	332	82 »

These figures clearly show the influence of selecting beets on the value of their yield. It may be said, it is true, that the higher yield of the modern beet varieties is due to better cultivation and heavier applications of manure and fertilizer ; but that does not weaken the influence of selection on the increased yield ; in fact, the new high-yielding varieties allow of heavy manuring, especially nitrogenous, which could not have been used previously because the commercial value of the beets would have so been affected that the extraction of the sugar would not have been sufficiently profitable. The present varieties, owing to their higher yield, not only allow of heavier manuring, but even require it their yielding powers are to be fully utilised.

It should be noted that the increased yield of the various sugar beet varieties is accompanied, both absolutely as well as relatively, by an increase in the quantity of foliage produced ; as the dry matter content has

also increased and as it is well known that beet leaves make excellent fodder, the new beet varieties have the advantage of producing a better quality and greater quantity of fodder than the old ones.

The lack of terms of comparison and the influence of meteorological factors may nullify these conclusions, but the mass of data, the extent of the determinations and the long period of years compensate the disturbing influence of these factors so as to show up still more the effect of selection.

529 - Experiments on the Catalytic Fertilisation of Seed Sugar Beets with Manganese Sulphate in Austria. — GREISENEGGER, J. K. (Mitteilung der Chemisch-technischen Versuchs-Station des Zentralvereines für die Rübenzucker-Industrie), in *Oesterreichisch-ungarische Zeitschrift für Zuckerindustrie und Landwirtschaft*, Year XLVI, Pt. 1-2, pp. 13-21 Vienna, 1917.

In view of the importance and uncertainty of the influence of manganese on plants, especially sugar beets, the author undertook an investigation not only into beets grown for fodder (1), but also into second year seed beets.

To 15 pots containing sand and peat were added 24 litres of KNOP'S nutritive solution and manganese in the form of sulphate in amounts equivalent to 22.3 lb. per acre to 5 pots and four times the quantity to 5 others; the remaining 5 pots were used as controls.

Although the smaller quantity had no *obvious* effect on the seed yield it had a reflex action in that it increased slightly the sugar content of the beets obtained from the seeds. The larger quantity of manganese markedly increased the production of seeds, but the beets obtained from them weighed less and contained less sugar.

In using manganese fertiliser a deceptive amount must not be applied. Many further experiments are necessary to determine if the limit is the same for all seasons and all varieties of beets.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

530 - Cacao in the Dominican Republic. — MC LEAN, A., in *Commerce Reports*, No. 283, pp. 876-877. Washington, D. C., 1917.

Cacao is, after sugar, the leading export of the Dominican Republic. The Spaniards introduced cacao in the Dominican Republic from Venezuela in the early part of the 18th century, but it is only within the past 25 years that the tree has been cultivated extensively. The Provinces of La Vega, Samana, Espailat, and Pacificador, in the northeastern section of the island, lead in the production of cacao in the Dominican Republic, but no statistics are available as to the total area planted.

Native methods of cultivating and preparing cacao for market are primitive and unsatisfactory. Almost all of the cacao is grown on small farms, and there are few large and scientifically managed plantations. These farms are mainly owned by Dominicans and are cultivated by labourers of the same nationality. Farm labourers receive from 50 to 60 cents a day, with a small shack and a patch of land to cultivate for themselves. There is no agricultural school nor experiment farm in the Dominican Republic.

(1) See R. 1916, No. 52. (Ed.)



lic, although both are badly needed in order to teach the people how to obtain the best results from their lands through the use of modern and scientific methods of cultivation.

The cost of land suitable for the cultivation of cacao in this Republic varies greatly, depending largely on its fertility and accessibility. The rich, black, alluvial lands in the humid and well-watered regions within easy reach of the Samana & Santiago Railroad and Samana Bay are considered the most desirable. Such lands are held at \$ 60 to \$ 75 an acre uncleared and from \$ 75 to \$ 90 cleared, the cost of clearing being from \$ 12 to \$ 18 an acre. The value of the lumber on the lands, which sometimes includes cedar and mahogany, would more than pay for the clearing but it is burned for lack of sawmills and means of transportation. Lands with bearing-cacao trees are valued at \$ 120 to \$ 150 an acre, with a rising tendency.

The cacao seeds in this island are planted directly in their permanent place in the field and not in nurseries as in some other countries. The seeds are planted in October to take advantage of the winter rains. Several seeds are usually planted together and when the seedlings are a year old the strongest are left to mature and the weakest destroyed. As a rule about 175 trees to the acre are left.

The variety of cacao planted most frequently in this Republic is known as "calabacillo", which bears small yellow pods with flat beans. The varieties known as "forastero" and "criollo" are also planted, but to a much less extent than the "calabacillo".

While the small plants are growing corn, yucca, bananas and plantains are planted between them, primarily for shade, but also to afford some returns while the cacao is maturing. As the cacao trees grow larger amapola trees are planted to give them shade. The ground between the cacao trees is cleaned with hoes and machetes, as ploughs are rarely used in the Dominican Republic. No windbreaks are used to protect the growing plants, nor is there any system of drainage on the plantations. As the lands on the island are very rich, the Dominicans have not as yet begun to use fertilizers.

The cacao trees begin to bear the fourth or fifth year, when they yield from one-half to 1 ½ lb. From about the seventh until the twenty-fifth year they are at their best, yielding as high as 3 ½ to 4 lb. per tree on the most fertile lands. Cacao trees have been known to live for more than 100 years, but they seldom bear after the sixtieth year. The trees are pruned every year, usually after the harvest.

The aphids and a number of other insects attack the cacao trees. It is said that these pests may be exterminated by merely spraying the trees with a solution containing refined petroleum, yet growers rarely make any attempt to get rid of them.

Cacao is usually transported from the farms to the towns on mule or horse back, as the roads are as yet impassable for carts and wagons. The principal towns in the cacao growing region — Moca, Salcedo, La Vega, and San Francisco de Macoris — are connected by railroad with the port of Sanchez, whence steamers sail fortnightly for New York. Cacao in this

market is usually packed in jute sacks, weighing 65 kg. net and 66 kg. gross. Prior to the war the freight was 45 cents per 100 pounds from Sanchez to New York, although at present it is exactly double that figure.

In the past five years cacao has been shipped from the Dominican Republic as follows.

*Cacao exported from the Dominican Republic, 1912-1915.*

Year	Kg.	\$
1912 . . . . .	20 832 602	4 248 724
1913 . . . . .	19 470 827	4 119 955
1914 . . . . .	20 744 517	3 896 489
1915 . . . . .	20 223 023	4 863 754
1916 . . . . .	21 053 305	5 958 659

In 1916, 22 249 540 kg. of cacao were shipped into the port of New York from the Dominican Republic. That was a greater quantity than from any other country. The next largest importations of cacao at New York during 1916 were 20 266 313 kg. from Ecuador, 15 805 710 kg. from Trinidad, and 14 471 783 kg. from Brazil.

Cacao from the Republic is known as "Sanchez" on the world markets. The cacao is bought up from the growers by the local exporters, who make them advances on their crops. The exporters usually ship their cacao to New York commission houses on consignment.

Despite the fact that it is one of the great cacao producing countries of the world, little or no chocolate or confectionery is manufactured in the Dominican Republic; practically all that is consumed is imported.

531 - **Hop-Growing in Galicia, Spain.** — I ROBBED, L. H., in *El Progreso agrícola y pecuario*, Year XXIII, No. 1036, pp. 506-507 Madrid, November 22, 1917; II. *El Cultivador Moderno*, Year VII, No. 2, pp. 11-12, 3 Figs Barcelona, February, 1918

At the present time there are in Spain about 20 breweries using, on an average, 196  $\frac{1}{2}$  cwt. of hops annually. The price of hops varies greatly in Spain, in 1912, the average price was 4s. 4d per pound; in 1916, American hops fetched 1s. 3d. per pound, and German hops, 1s. 9  $\frac{1}{2}$  d. per pound at the breweries. The hops used by the author at the Agricultural Station of Corunna in 1917 cost 1s. 11  $\frac{1}{2}$  d. per pound.

As hops grow wild in Galicia, the author introduced from England, in 1915, the varieties Golding, "dorado de Inglaterra", white, and green, and cultivated them at the Corunna Station. The deep, sandy soil, rich in humus, was given 16 tons of manure per acre, and was ploughed to a depth of 16 in. Cuttings were planted about 5  $\frac{1}{2}$  feet apart in squares. At the beginning of May the scarifier was used once, and the land twice hoed lightly. The harvest was in mid-September. The hops were dried in the kiln on frames one above the other, with a distance of about 8 inches between each one. At the end of October the plants were cut down to about 12 inches above the ground. The highest yield in 1916 was obtained from the variety "dorado de Inglaterra", which gave 28.61 cwt. per acre of green fruit, corresponding to 9.16 cwt. of dried fruit. This is an excellent result,

especially considering that it was obtained in the second year of cultivation, that is to say, before the plants had attained their maximum yield. The quality was excellent. The cost of cultivation amounted to £ 2.17.9 per acre.

532 - **Results Obtained in Italy from the Sowing of Wild-Fig Seed.** — LONGO, B., in *Atti della Reale Accademia dei Lincei*; Series V, *Rendiconti*, Vol. XXVII, Pt. 1, 1st. Half-year, pp. 55-57. Rome, January 6, 1918.

FRUIT  
GROWING

M. CAVOLINI, M. GASPARRINI, and the author in Italy, and M. LECLERC DU SABLON in France, have shown that *Ficus Carica*, both when wild and when cultivated, occurs in two forms — the ordinary fig and wild-fig. It has also been shown experimentally, first by M. GASPARRINI, then by M. TRABUTI that if the fig (*i. e.*, the small fruit of the second figs) is sown, the ordinary and the wild-fig are obtained. It remained to show what would be obtained by sowing the few small fruits found between the galls of the second figs of the wild-fig tree. In 1912, the author sowed both wild and cultivated wild-fig seed; the plants obtained began to bear fruit in 1917, and proved to be partly ordinary figs, partly wild-figs. The seed of wild-fig, like those of the ordinary fig, thus gave both types of plant.

533 - **The Native Bananas of the Hawaiian Islands.** — MACCAUGHEY, VAUGHAN (College of Hawaii, Honolulu), in *The Plant World*, Vol. XXI, No. 1, pp. 1-12. Baltimore, January, 1918.

As amongst all the Polynesian peoples, the banana was an important article of food amongst the ancient Hawaiians, and all explorers mention its abundance round the settlements. This profusion was doubtless due to the ease with which the plant is propagated, the little attention needed to cultivate it, its great productivity, perennial character, and its nutritious and palatable fruit. The decrease in the native population lowered the value of the banana as a food. As its cultivation gradually increased again, foreign varieties (chiefly the Chinese variety) were imported from time to time and superseded the native varieties both in the plantations and on the market. Among the imported foreign varieties are: —

*Musa Cavendishii*, a Chinese banana introduced from Tahiti about 1855; it is the most important and widely-grown commercial variety and there are extensive plantations of it round Honolulu; the local consumption is large and considerable quantities are exported to California; owing to its dwarf size and deep roots it suffers less from storms than the taller varieties.

*Musa Fehi*, also imported from Tahiti; the stem of the bunch is erect instead of hanging pendant as is the case with most bananas; the fruit is of fair quality when cooked.

The Brazilian banana was also imported from Tahiti about 1855; it reaches a height of from 26 to 35 feet; it is firm-rooted and is often used as a windbreak for more fragile varieties; the fruit is of excellent flavour, slightly acid.

Other foreign varieties are Bluefields, Ice Cream, Apple, Lady Finger and Abaca, or Manila hemp (*Musa textilis*).

The cultivation of the native varieties is beginning to develop in all the plantations. All the native varieties, of which the author describes 22, are derived from *Musa sapientum*. They may be divided into three groups,

each belonging to one of three dominant types, known locally as Maoli, Iho-lena and Po-po-ulu.

All the native varieties are seedless and could only have been introduced into the islands by human agency; the roots and "suckers" are quickly killed by sea-water, and could, therefore, not have been carried by ocean currents as is the case with many seeds with impervious tegument. The banana, with other plants and animals must have been imported by the Hawaiians when they immigrated. The first villages were along the coast, and the primitive agriculture of the native naturally developed in the near valleys and lowlands rather than in the mountainous districts of the interior. However, as the rainfall in the plains was not sufficient to satisfy the requirements of the plant, which needs much moisture, the banana plantations gradually spread along the wet upper valleys, where the plant was also sheltered from the strong winds, and the inland rain-forests. The banana does not suffer from shade, and coolness does not seriously retard the ripening of the fruits.

It thus happened that most of the groves were at some distance, often several miles, from the villages. The plants propagated spontaneously, and when the native population declined, formed practically wild groves, wild in the sense that they have escaped from cultivation, but they are not indigenous.

Banana groves are sometimes found at heights of 3 500 to 4 500 feet. The plants are usually dwarfed and produce little, and the fruit rarely ripens, being eaten by rats before it reaches maturity, which is considerably retarded by the cold.

The banana trunk may reach a diameter of 3 or 4 feet. It emits numerous shoots by which the plant may be indefinitely propagated. The plants are easily uprooted, and, in rainy districts, are often torn up by mountain streams which carry them some distance till they lodge in a suitable crevasse, where they root take and sprout again.

All these varieties are, therefore, easily transplanted, and many private groves in Honolulu contain plants collected from the mountain districts of the interior and from the other islands. For transplanting a sucker or offshoot 2 or 3 feet tall is generally taken. This is carefully separated from the parent plant so as not to injure its base, and planted in mellow soil with about half of the shoot underground. It grows rapidly and bears fruit 10 or 15 months later. The ancient natives used the fibre from the leaf-sheaths as a textile, but since the introduction of cheap cotton thread its use has gradually died out. The tissues of the plant contain a watery latex which turns dark brown or black when exposed to the air, and was used by the Hawaiians to stain their household utensils, gourds, etc.

Many of the native varieties are only edible after having been cooked; these are known as "cooking bananas". Heat changes the starches into sugars and the flesh of the fruit is saturated with a delicious sugary syrup. The cooking bananas are also largely used by the white settlers; they fetch a good price and their popularity is bound to increase as their food value becomes better known.

The native Hawaiian banana has, then, re-won its position as a food. The author believes the best varieties will be put on the market in increasing numbers and will finally become one of the most important exports of the Pacific Islands. There is no reason why it should not become an important food in America with a commercial development similar to that of canned pineapple.

534 - **The Mango in Porto Rico.** — KINMAN, C. F., in *Porto Rico Agricultural Experiment Station, Bulletin* No. 24, pp. 33, 2 Tables + XI Figs. Washington, 1918.

These observations are drawn from the work of several years during which trees of many varieties have been imported, propagated and in some cases brought into satisfactory production.

The common mango of Porto Rico, which is one of the most important fruits of the island, is not cultivated but grows wild in all localities. Superior varieties lately imported have proved satisfactory and should be planted extensively for market and home use.

Mango trees are adapted to a wide range of soil types and will grow satisfactorily in practically all Porto Rican soils, provided there is a good subdrainage.

While the climate throughout the island is suitable for the growth of mango trees, in some localities, notably through the interior and along the northern slopes, rains are sometimes too frequent during the blossoming season to permit the setting of a good crop of fruit. Along the western and northern lowlands rainfall is light during the blossoming season and good crops are almost invariably secured.

As the prevailing winds and morning sun seem to be very beneficial, both for growth of trees and setting of fruit, open, exposed sites should be selected for the mango orchard.

Inarching and bark grafting are satisfactory both for use in the nursery and for topworking large trees.

Large seeds which produce only one plant are most satisfactory for stocks. The East Indian varieties produce larger and more thrifty plants, as a rule, than the native kinds. Both nursery and other mango trees may be transplanted successfully if they are not making a new growth and rainfall is plentiful.

The present confusion in the classification of types of mangoes, as well as the great variation in growth and productiveness of trees, and quality of fruit, necessitates a thorough study of varieties before a mango orchard can be successfully planted in Porto Rico.

Among a number of imported varieties that have fruited there, the most productive of the thrifty kinds with fruits of high quality are Cambodiana Totafari, Amini, Bennett, and Paheri. Cambodiana and Paheri are probably better suited to home than to commercial use.

The trees of the few varieties from Martinique, Trinidad, and South America thus far tested lack vigour, while the fruits are either inferior in quality or too small to be promising for general planting. As regards size, flavour, fibre content, and keeping quality, the wild Porto Rican mangoes are less desirable than many imported kinds.

In harvesting mangoes that have not softened on the tree, a stem longer than the fruit stalk should be left to prevent the juice from the base of the fruit from escaping through the fruit stalk and leaving passages for the entrance of infection.

Fruits in orange wrapping paper did not ripen or decay so quickly as those wrapped in oil paper, newspaper, or coconut fibre, or those left in the open air. Fruits packed in coconut fibre ripened earliest. East Indian varieties showed much better keeping qualities than the native kinds.

The mango is one of the most satisfactory ornamental trees for Porto Rico, as variations in habit of growth and colour of foliage make it possible to select from varieties producing fruit of high quality those which best carry out a particular scheme of landscape gardening.

#### VINE GROWING

535 — **Direct Bearers: I. In the Department of the Isère; II. In the Department of the Loire (France).** — I. CAILLE, L. and ROUGIER L. in the *Revue de Viticulture*, Year XXV, Vol XLVIII, No 1230 Paris, March 28, 1918 — II. BLANCARD, *Ibid.*, No 1210, pp. 215-221 April 1, 1918

I. — In a report on his experimental field of direct bearers, M. CAILLE, Professor of Agriculture at Vienne, Isère, states that the vines best suited to that district are: —

a) *Vines with coloured grapes*: — Gaillard No. 2 for earliness and Seibel 41, 47, 1000, 1020, 2007, Couderc 106-46 for satisfactory ripening.

b) *Vines with white grapes*: — Castel 1028, Couderc 272-60, Seibel 880, Bertille Seyve 450.

To these might perhaps be added Prof. C. 221, which is very strong and ripens somewhat late; it should be pruned long. Without Prof. C. 221, this makes 11 varieties of obviously varying value. As a rule they all yield regularly and are worth testing. They are, however, not all equally fertile; Castel 1028, Seibel 2007 and 1020, and Couderc 106-46 appear to give the best crops. At the Vienne experiment field two applications of neutral sub-acetate of copper are given, one before flowering and the other immediately after.

To this information Mr. ROUGIER, Director of the Agricultural Service of the Isère, adds a few remarks applying more especially to the south and east of the department. In places where French vines are exposed to frost in winter the use of winter frost-resistant hybrid direct bearers is essential. Among such hybrids are Seibel Nos. 1, 28, 156, 100, Gaillard 157 (white) and 2 (red), and Couderc 4401. The last is more especially suited to the clay soils of the plains.

II. — The author (Agricultural Engineer, Director of the Agricultural Service of the Loire) mentions the hybrids which would probably prove of value in the Department of the Loire. As a rule these are early plants or those of the first period, though in the warm districts of the Loire some later varieties could be grown. These plants, moreover, give produce free from foxy taint.

A) **RIPARIA HYBRIDS.** — The fruit of some of them is large, and their wine is generally good.\* The bunches are high on the branches, thus requiring the use of wire or props. They are resistant to phylloxera (Riparia

influence), very vigorous and develop their branches with great rapidity. Flowering is very rapid thus protecting them against vine moths and non-setting,

*Black.* — Couderc No. 1 or Pinaud-Couderc, 633 H., Oberlin 595, 604 and 605.

B) RUPESTRIS HYBRIDS. — The most widely used are Rupestris, Lincecumii, Vinifera. They are generally productive and give good wine. They are very resistant to mildew. The bunches are borne low on the branches. They may be pruned low or spur pruned without props, nevertheless it is always preferable to put in stakes.

*Black.* — Couderc 7, 8, 7106, 7120, 4401 (the L. Buffet selection of which has very large fruit) ; Seibel 1000, 2859, 4643.

*White.* — Couderc 117-3, 272-60 ; Seibel 880, 4681.

C) COMPLEX HYBRIDS. — *Black.* — Bertille-Seyve 872, 822.

*White.* — Bertille-Seyve 450 ; Noah (B. S. 450 is a Noah crossed with Seibel 2003).

D) OTHER HYBRIDS. — Gaillard 2 (black), 157 (white) ; Fournié (Riparia-Rupestris-blue Portugais), Poirier 19 637.

536 — **The Red Spruce : Its Growth and Management in the United States.** — MURPHY, L. S., in the *U. S. Department of Agriculture, Bulletin No 544*, p. 100 + Plates I-VII. Washington, October 31, 1917.

FORESTRY

Red spruce (*Picea rubens* Sarg.) is one of the most important woods of the north-east of the United States, where it is found in pure or nearly pure stands. It is used more than any other wood in the manufacture of paper and supplies a large amount of lumber and other material. Of the 116 500 million feet board measure of standing spruce timber in the United States (4 % of the total timber), 48.3 % is composed of red spruce, 30.3 % of the Rocky Mountain or Engelmann spruce, and 21.4 % of the Sitka spruce. These figures concern the districts where this timber is of commercial importance; white spruce, black spruce, Colorado blue spruce and *P. Breweriana* Watts occur also.

The most important by-products of red spruce are the resin, used as chewing gum, and the extract from the tender tips of the branches which forms the basis of spruce beer, a non-alcoholic beverage, formerly very popular, especially amongst sailors, who considered it to be a preventative against scurvy. On account of its lightness, strength, reliability and freedom from hidden defects, spruce wood has recently come into general use in the manufacture of aeroplanes.

Many methods of management have been adopted by the large timber and paper manufacturing companies, who use spruce wood more largely than any other wood. The bulletin under review attempts to determine the methods most suited to various conditions. It is estimated that, under average natural and uniform conditions, 50 to 60 years are necessary for the maximum production of wood used for paper pulp; if judicious thinning is carried out this period may be shortened by 5 to 10 years. For timber production 100 to 120 years either in virgin or selection forests are required.

The bulletin ends with an appendix containing many volume and measurement tables.

- 537 - **Forest Yield of Public Land in Spain** (1). — BERNARD. F., in *Real Sociedad Española de los Amigos del Arbol, Boletín Oficial de la Sociedad*, Year VII, No. 72, pp. 1-2. Madrid, 1917

According to the data obtained for the year 1913-1914, the forests declared of public utility, which depend on the Ministry of the "Fomento", cover in Spain and the neighbouring islands an area of 11 886 349 acres, 29 888 acres less than in the year 1912-1913 due to a rectification of the boundaries. These figures include 609 379 acres (i. e., a little more than 5 %) belonging to the State, 11 261 746 acres belonging to communes, and 15 224 acres belonging to other public bodies.

Of the total area, 1 020 304 acres (i. e., 8 % of the acreage of public forests) are being divided up for cutting and 288 891 acres of mountain land are being regenerated and replanted.

The various kinds of trees found in the forests are distributed as follows:— 5 263 223 acres of full-grown pine, oak and beech; 3 088 860 acres of thicket and 3 534 260 acres of brushwood and pasture land. The income from these forests is estimated at £ 412 247 (*at par*). The principal items are:—

Pasture land . . . . .	£ 192 994
Timber . . . . .	87 516
Resin . . . . .	47 861
Firewood . . . . .	39 437
Cork . . . . .	16 883
Esparto . . . . .	6 499

A profit is also obtained from grazing acorns, fruit, roots, etc. There are great differences in the prices of the various products, less on account of the quality than difficulty of transport. Thus, standing pine costs from 5.98 *d.* to £1.18.0 per cubic metre (1 cubic metre = 35.31 cubic feet), English oak from 3s.1.66*d.* to 18s.5.42*d.*, beech from 5.70*d.* to £1.18.0 (*at par*).

The requirements of industries which utilise various forest products call for increased exploitation of the forests, while, at the same time, the maintenance of livestock and breeding demands improved pasture land.

- 538 - **Timber of British Guiana.** — See No. 497 of this Review.

- 539 - **The Galls of *Tamarix articulata* Vahl.** — TRABUT, L. (Professor of the University of Algiers, Director of the Botanical Service of the General Government of Algeria), in *Bulletin de la Station de Recherches Forestières du Nord de l'Afrique*, Vol. I, Pt. 5, pp. 171-182 + 6 Figs + 2 Plates. Algiers, 1917.

The "takaout" gall of *Tamarix articulata* Vahl, known as "ettl" or "tlaia", was well known to the ancients, except that Dioscorides and later writers confound the gall with the fruit of the tree because the galls usually develop at the expense of the flowers, taking the place of the fruit.

(1) See B. 1912, No. 930. (*Ed.*)



In India the galls of *Tamarix* are used in tanning, dyeing and medicine. In the Sahara, *Tamarix articulata* sometimes forms veritable forests; it is the most important tree the Touaregs have, both by reason of the numbers in which it occurs and its utility.

For a long time the gall of *Tamarix articulata* was believed to be caused by a Lepidopteron (*Pamene pharaonana*), but according to the author it is caused by a mite (*Eriophyes tlaiae* Trab, of the same genus as *E. tamaricis* Trotter).

Most of the commercial galls are flower galls, and smaller and more regular than those of the branches, which may be as large as a nut. The author's observations showed the possibility of forcing the growth of galls on all *Tamarix* which are old enough to flower, thus solving the problem of the production in large quantities of a much valued raw material. In 1883 the Tlemcen tanners paid up to £1.3. 2 ½ per 100 lb.; the present price is 14s. 2 ½ d.

A chemical analysis of the flower galls gave the following results:—

Moisture. . . . .	12.5 %
Extractive matter. . . . .	44.0 %
Tannin. . . . .	55.2 %

The galls form in summer and may be harvested in autumn. The *Tamarix* is easily propagated by cuttings and may be used for fixing sand on the coast. Although it is difficult to estimate the yield in galls it must be heavy considering that infected trees always bear a large quantity, so that a harvest of from 16 to 23 cwt. per acre is not unlikely.

The author recommends experimental plantations of *Tamarix articulata* in soils unsuited to other crops, such as sand and saline steppes, which form a large proportion of the unproductive lands. The *Tamarix* might modify advantageously the flora of such lands by favouring the growth of forage suitable for feeding sheep. Cattle eat the twigs of *Tamarix*.

540—**Forest Fires in the United States in 1915** (1).—PETERS, J. G. (Chief of State Cooperation Forest Service), in *U. S. Department of Agriculture, Office of the Secretary, Circular* No. 69, pp. 6. Washington, January 11, 1917.

The statistics contained in this circular represent the first attempt at an annual estimate of forest fires in the United States. In general the most comprehensive reports were those obtained from States with organised forest-fire protective systems and from the National Forests. Where no protective organisations existed attempts were made to obtain estimates from the civic divisions of the States and from rural mail-carriers. By this means data were obtained from 37 States, representing about 56% of the forest area of the United States. These States may be divided into three groups:—1) those giving data covering the total forest area; 2) those giving data covering 60 to 99 % of this area; 3) those giving data covering less than 60 % of the area.

The figures obtained made it possible to draw up the general classification shown in Table I.

(1) See B. 1912, No. 1312. (Ed.)

TABLE I. — *Forest Fires and their Causes in the United States in 1915.*

Causes	Number	Percentage
Lightning . . . . .	2 298	10
Railway . . . . .	3 548	16
Lumbering . . . . .	728	3
Brush-burning . . . . .	3 545	16
Campers . . . . .	2 347	10
Incendiary . . . . .	1 751	8
Miscellaneous . . . . .	2 384	11
Unknown . . . . .	5 867	26
<i>Total . . . . .</i>	<b>22 468</b>	<b>100</b>

Total area burned . . . . .	3 306 650 acres
Average area burned per fire . . . . .	147 "
Total loss caused by fires . . . . .	\$ 4 009 356
Average loss per fire . . . . .	\$ 179
Average loss per acre . . . . .	\$ 1.20

These data concern 304 864 000 acres, belonging to the States from which reports were obtained. An estimate for the total forest area of the United States gives the following figures : —

Area . . . . .	544 400 000 acres
Number of fires . . . . .	40 000
Area burned . . . . .	6 000 000 acres
Loss . . . . .	\$ 7 000 000

That is to say the area burned represented 1.1 % of the total. Moreover, the loss in young tree growth and the very great damage due to soil deterioration and floods have not been included.

The returns obtained in the United States show that where there is a protective system most of the fires can be controlled before making headway, and that extensive and destructive fires are few as compared with States having no such protective system. This argues strongly in favour of the formation of adequate systems of protection in all States. The figures in Table II show the cost of such a system.

TABLE II. — *Cost of Protection against Forest Fires in the United States in 1915.*

Protected forest area . . . . .	405 550 000 acres
Total expenditure . . . . .	\$ 2 738 999.80
Federal Government expenditure	
On National Forests . . . . .	\$ 2 153 728.17
On State and private lands . . . . .	\$ 71 860.02
Expenditure of States with protective systems	\$ 513.411.61

## LIVE STOCK AND BREEDING.

541 - The Chemical Composition of Lime-Sulphur Animal Dips. — CHAPIN, ROBERT M., in *U. S. Department of Agriculture, Bulletin No. 451*, 16 pp.; Bibliography of 10 Publications. Washington, D. C., December 11, 1916.

HYGIENE

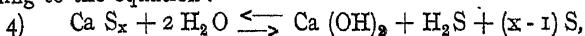
Some of the numerous reactions which determine the composition of lime-sulphur solutions are reversible, the points of equilibrium varying according as the solution is hot or cold, dilute or concentrated, or exposed to the influence of other varying conditions. Under such circumstances the only way in which laboratory studies can be of practical value is by so thoroughly establishing the fundamental principles involved and the effect of varying conditions upon the relative importance of such principles as to afford a sound basis for reasoning.

It appears that when lime and sulphur are boiled with water, ignoring unessential and hypothetical intermediate compounds, the following reactions occur: —

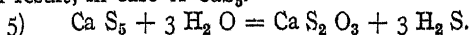
- 1)  $3 \text{ Ca (OH)}_2 + 12 \text{ S} = 2 \text{ Ca S}_5 + \text{Ca S}_2 \text{ O}_3 + 3 \text{ H}_2 \text{ O}$
- 2)  $10 \text{ Ca S}_5 + 3 \text{ Ca (OH)}_2 = 12 \text{ Ca S}_4 + \text{Ca S}_2 \text{ O}_3 + 3 \text{ H}_2 \text{ O}$
- 3)  $\text{Ca S}_4 + \text{S} = \text{Ca S}_5$

Only when substantially all free sulphur has been dissolved will equation 2 become operative or equation 3 fail to hold all polysulphide substantially up to the pentasulphide.

All lime-sulphur solutions are subject to hydrolytic decomposition according to the equation: —

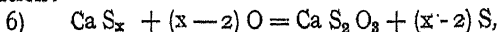


the pressure of the reaction from left to right increasing with rise of temperature. Whether or not hydrogen sulphide can escape, the remaining products on the right-hand side react according to equation 1, giving as final result, in case of  $\text{Ca S}_5$ ,



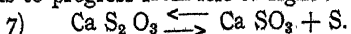
Thus all solutions are in equilibrium only when they contain a certain excess of hydrogen sulphide, the amount being dependent upon the temperatures and concentrations of the solutions.

Solutions exposed to air are oxidized, as is usually represented by the equation: —



although it is possible that, as propounded by DIVERS and SHIMIDZU, the immediate action is an oxidation of the hydrogen sulphide liberated according to equation 4.

Above a certain concentration of the hot solution, which appears to lie between 3.33 and 3.95 per cent of monosulphur, the following reaction tends to progress from left to right: —



A well-boiled solution, not originally made with an excess of lime, can never under any circumstances possess a plus reaction figure — that is, it cannot contain calcium hydroxide in excess of monosulphur. If original-

ly made with an excess of lime or if not boiled long enough, excess lime is at first present in solution. But if such a preparation be allowed to stand quietly and cool off in the cooking vat, the indications are that the undissolved lime soon settles down, while the small amount of dissolved lime rapidly reacts with polysulphur according to equation 2, so that in this case also, unless the cooled solution is again stirred up with the sediment, a plus reaction figure can never be present in the end. Such a solution will naturally contain a notable amount of tetrasulphide.

As regards the period of boiling, it is not improbable that the time should be increased with increasing concentration. Lime is but slightly soluble in the solution at any stage, and it must probably dissolve before it can react with the sulphur. It would seem, therefore, that a longer time must necessarily be required in a given volume for a large quantity of lime to enter successively into solution and into reaction than for a small quantity.

As regards the effect of the degree of concentration, in addition to the decomposition of thiosulphate which has been noted, the indications are that with increasing concentration the utilisation of both lime and sulphur possibly becomes less nearly complete and also that the polysulphides formed possibly contain a somewhat less proportion of pentasulphide. But the apparent effect might have been produced simply by insufficient boiling, and in any case it is of no material significance in comparison with the practical importance of putting out proprietary preparations in highly concentrated form.

Finished solutions, if stored over sediment which contains free lime, will naturally tend to maintain a plus reaction figure and will undergo changes attributable to the slow progress of reactions 1 and 2. If decanted from sediment and preserved from access of air, only two slight changes are noticeable; firstly, the progress of equation 5 until a certain concentration of hydrogen sulphide is reached, when equilibrium is established according to equation 4; secondly, an apparent slight drop in the thiosulphate figure, for which no explanation is offered, since the phenomenon appeared too quantitatively insignificant to warrant special investigation. Both changes, in fact, are so slight as to be entirely negligible for practical purposes under ordinary conditions.

For the actual preparation of lime-sulphur solutions equations 1, 2, and 3 call for the use of 43.7 parts of available calcium oxide to 100 parts of sulphur. That the laboratory experiments did not precisely check this theoretical ration is attributable solely to the decompositions represented by equations 5 and 6. The decomposition represented by equation 5 is independent of the formula employed and in no way changes the relative proportions of primary ingredients called for; that is, equation 5, following the postulated escape of hydrogen sulphide, produces neither free lime nor free sulphur, and leaves the solution neutral. There remains then only the matter of oxidation to be considered. That is a surface action solely, and considering the enormous advantage in the ratio of volume to surface possessed by even moderate-sized cooling vats over laboratory apparatus, it approaches a negligible factor. Therefore the theoretical ratio becomes

the actual ratio which should be followed in practice, provided only the concentration is not sufficient to allow equation 7 to progress from left to right. The formation of sulphite becomes a significant factor when the formula employs somewhat more than 20 parts of sulphur per 100 volumes of finished solution. For a number of reasons the writer believes that it will be generally inadvisable to try for a much higher degree of concentration in "home-made" solutions. Certainly in such solutions no allowance should be made for the formation of sulphite by increasing the ratio of lime to sulphur, as the extent of the decomposition is too dependent on the degree of concentration and length of boiling after the solution is otherwise complete. Attempts to make more concentrated solutions are attended by greater difficulty in manipulating the thick liquid and in avoiding loss by boiling over, and moreover involve more loss of the finished solution in the wet sludge, especially since the volume of sludge is increased by deposition of calcium sulphite.

Nowhere is there evidence of the existence in cold solutions of more sulphur, either free or combined, than corresponds to the formula  $\text{Ca S}_5$ . On the other hand, a properly prepared home-made solution will contain at most but a small amount of tetrasulphide. It will also contain a very small amount of hydrogen sulphide, some of which may possibly be in the form of calcium hydrosulphide. While rigidly scientific proof is perhaps lacking that the two apparently definite proportions of four atoms and five atoms of sulphur respectively to one atom of calcium may not, in fact, arise from mixtures of lower and higher polysulphides, it is certainly true that all available evidence points to the existence of only these two.

The methods of analysis have proved to be adequate in scope and accuracy as well as practical. Working in the ordinary way with flasks and pipettes the analyst apparently will not recover from a concentrate more than 99 per cent. of the monosulphur, which indicates a recovery of 99.75 per cent. of the polysulphur, or 99.6 per cent of the sulphide sulphur, calculating on pentasulphide only. The loss arises chiefly from oxidation during manipulation of the solutions and may be reduced only by manipulating in an atmosphere of some inert gas.

*Practical applications.* — It is logical to deduce from the data here presented a working formula for the preparation of lime-sulphur solutions. The subject has been dealt with by a number of investigators primarily interested in the preparation of such solutions for horticultural spraying purposes. Some the formulae so developed seem to have given entire satisfaction for the purpose for which they were intended and the dilutions at which the resulting products should be employed under various conditions have become so well established that any change in formula would be of doubtful practical benefit. It is quite otherwise with solutions intended primarily for the purpose of dipping cattle and sheep. The formulae in use are those prescribed by the Bureau of Animal Industry many years ago when uncertainty regarding possible chemical reactions and possible effects of the resulting compounds upon both animals and parasites very properly led to the use of formulae which should be certain and

safe, even if somewhat uneconomical. The formula suggested here is proposed, therefore, solely for use as an animal dip. It may be termed the "8-18-10" formula; that is, 8 pounds of high grade commercial quicklime, 18 pounds fine sulphur (either flowers or flour) with somewhat more than 10 gallons of water, boiled to a volume of 10 gallons at the finish. The time of actual boiling should be one hour. The theoretical ratio between lime and sulphur will be met by this formula if the lime is 98.3 per cent pure, therefore the formula as given is suitable for the preparation of a solution for dipping sheep where any danger of an excess of lime must be avoided. If commercial hydrated (not air-slaked) lime is used the amount should be increased nearly one-third, say to 10.5 pounds. For dipping cattle the formula may be used on the basis of available calcium oxide if the analysis of the lime is known; if this not known the lime may safely be raised to 8.5 pounds, corresponding to 92.5 per cent available calcium oxide, possibly even to 9 pounds. The manipulation of the materials in the actual process of preparation has been described in a recent publication from the Bureau of Animal Industry (IMES, MARION, Sheep Scab. *U. S. Dept. Agr. Farmers' Bull.* 713, 36 pp. Washington, 1916).

The finished solution, drawn off from the sediment, should theoretically contain 18 per cent (grams per 100 cc.) of sulphide sulphur, but will probably contain somewhat less. It is, therefore, suitable for dipping sheep at a dilution of 1 volume of concentrate to 9 or 10 volumes of water, and for cattle at a dilution of 1 volume of concentrate to 7 or 8 volumes of water. But in any case, since baths lose strength during dipping, it is very desirable to keep them at all times under control by means of a "field test" (CHAPIN, ROBERT M. A Field Test for Lime-Sulphur Dipping Baths. *U. S. Dept. Agr. Bull.* 163, 7 pp. Washington, 1915).

The particular advantages of the above formula are, firstly that it closely approaches the theoretical ratio, making allowance for impurities; secondly it is as concentrated a product as can be prepared without conversion of thiosulphate to sulphite; and thirdly, the figures are easily remembered and readily converted into the quantities of ingredients necessary to prepare a batch of any desired size.

In deducing a formula for the preparation of highly concentrated proprietary solutions it is evident that the manufacturer must make a few tests with plenty of sulphur in order to establish the conditions which will uniformly yield the product he desires, analysis of which will then show him by how much he may safely reduce the sulphur to allow for the formation of sulphite.

**542 - The Toxicity of Carotin.** — WELLS, GIDEON H. and HEDENBURG, O. F. (Department of Pathology of the University of Chicago), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 213-116. Baltimore, Md., 1916.

In the course of an investigation of the effects of the bleaching of flour by chlorine gas, it became necessary to ascertain the possible toxicity of the pure pigment matter — carotin (1) — both bleached and unbleached.

(1) Only 1 gm. of colour is contained in 1000 kg. of flour. (*Ed.*)

The purified pigment, chlorinated or not, was dissolved in olive oil, sterilized and injected in guinea pigs intraperitoneally and intradermically. Such large amounts as 0.2 gm. given intraperitoneally or 20 gm. injected intradermically had no effect or caused only a local oedema and inflammation, but no necrosis. Therefore it may be safely concluded that even in relatively very large doses carotin, whether in its natural state or saturated with chlorine, is almost entirely devoid of toxicity.

The studies of PALMER and ECKLES (*Journal of Biological Chemistry*, Vol. XVII, p. 191, 1914) indicate that carotin is almost universally distributed throughout all animal bodies, coming chiefly, if not solely, from the food. The experiments of the authors seem to be sufficient to warrant the assumption that any such quantities as can ever accumulate in the tissues have no harmful effects.

**543 - Studies in Blackleg (Symptomatic Anthrax) Immunization with Special Reference to Blackleg Filtrate.** — EICHORN, A, in *Journal of the American Veterinary Medical Association*, Vol. LII, No. 6, pp. 651-669. Ithaca, N. Y., February, 1918.

Up to the present the most common method of vaccination for immunization against blackleg (symptomatic anthrax) consisted in the injection of attenuated virus prepared in either pellet or powder form.

With this method direct losses from vaccination are known to occur from time to time and insufficient protection following vaccination is also of too common occurrence.

The first investigation on attempts to utilise filtrates of bacterial growths of blackleg cultures for immunization purposes are recorded by FOTH. Japanese investigators have continued the work along the lines developed by FOTH and, according to Prof. NITTA of the Tokio University, the filtrates obtained appear to afford uniform protection, entirely avoiding losses from vaccination.

The experimental work reported in this paper dealing with the preparation, standardization and immunizing properties of blackleg filtrate, fully substantiated these claims, with the following results: —

- 1) Blackleg filtrate is an effective immunizing agent against blackleg.
- 2) Blackleg filtrate confers an active immunity which protects cattle against the disease for as long a period of time as the germ-free extracts (agressins) prepared from the juice of the tissues from affected cattle.
- 3) Since it does not contain the blackleg germ in any form it cannot produce the disease, therefore losses incidental to vaccination with the powder or pellet form are entirely avoided.
- 4) Blackleg filtrate may be prepared in a concentrated form and, when suitably preserved, will retain its potency for an almost indefinite period of time.
- 5) It is essential to subject the blackleg filtrate to the various tests for sterility, both during the filtration and filling processes in order to guard against any possible contamination.

544 - On the Possibility of the Passage of Trypanosomes into Milk (1). — LANFRANCHI, A., in the *Atti della Reale Accademia dei Lincei*, Series V, *Rendiconti*, Vol. XXVII, Pt. I, 1st. Half-Year, pp. 62-67. 1 Diagram. Rome, January 6, 1918.

The author wished to ascertain:— 1) if young animals left at the udder would be infected; 2) if it is possible to ascertain the presence of trypanosomes by the direct examination of the milk; 3) if the milk, on inoculation into the peritoneum, could infect rats and mice.

The results have shown that:— 1) *Trypanosoma Brucei*, T. Evansi, T. Lanfranchi, can pass into the milk of rats; 2) *Trypanosoma Evansi* and T. Lanfranchi can pass into the milk of guinea-pigs; 3) *Trypanosoma Lanfranchi* can pass into the milk of mares; 4) the *Lanfranchi virus* can transmit the infection to new-born guinea-pigs through suckling.

The almost universally-recognised fact that trypanosomes in general do not pass from the mother to the foetus, has again been confirmed.

ANATOMY  
AND  
PHYSIOLOGY :  
GENERALITIES

545 - The Basal Catabolism of Cattle and Other Species. — ARMSBY, HENRY PRENTISS, FRIES, J. AUGUST and BRAMAN, WINFRED WAITT, in *Proceeding of the National Academy of Sciences*, Vol. IV, No. 1, pp. 1-4 Bibliography of 12 Publications. Washington, D. C., January 15, 1918.

The basal catabolism of herbivora and especially of ruminants, unlike that of man or carnivora, cannot well be measured in the fasting state on account of the relatively large amount of feed always present in the alimentary canal of the former species. It may, however, be determined indirectly in the manner described by the authors by measuring the total metabolism upon two different amounts of the same ration and from these data computing the level to which the metabolism would be reduced were all feed withdrawn. For example, a steer receiving two different amounts of the same mixed ration gave the following results:—

	Dry matter eaten daily	Daily heat production
	kg.	calories
Period 2 . . . . .	9.146	16,511
Period 1 . . . . .	4.463	10,905
Difference . . . . .	4.683	5,606
Heat increment per kilogram of dry matter .		1.197

Evidently, out of the total metabolism of 10 905 calories in Period 1,  $1\ 197 \times 4.463 = 5\ 342$  calories may be regarded as the heat production caused by the 4.463 kg. of dry matter eaten, while the remainder, 5 563 calories, is the basal catabolism.

The writers' investigations upon the metabolism of cattle (2) afford

(1) See R., July 1916, No. 767. (Ed.)

(2) ARMSBY and FRIES, U. S. Department of Agriculture, Bureau of Animal Industry, *Bulletin* 128, 1911. — ARMSBY, *ibid.*, *Bulletin* 142, 1912. — ARMSBY and FRIES, *Journal of Agricultural Research*, Washington, Vol. III, p. 435, 1915; Vol. X, p. 599, 1917; Vol. XI, 1917. See also B. January, 1912, No. 149; December, 1912, No. 1646; June, 1915, No. 625. (Ed.)



data for computing in the manner just illustrated the basal catabolism of ten unfattened steers in twenty-seven experiments. In view of the very striking effect of standing in increasing the metabolism of cattle the basal catabolism per 24 hours has been computed separately from the observed rate of heat production during the intervals of lying and standing respectively, and also for 12 hours standing and 12 hours lying per day, assumed as representing average conditions.

As was to be expected, the basal catabolism increased with the size of the animal but with very considerable fluctuations. The graphs of the results indicate an equally close relation of the basal catabolism with the weight and with the two-thirds power of the weight (computed body surface) and this conclusion is confirmed by a comparison of the coefficients of correlation as follows:—

	With live weight	With $\frac{2}{3}$ power of live weight
Basal catabolism, lying 24 hours . . . . .	0.8655 $\pm$ 0.0326	0.9032 $\pm$ 0.0239
Basal catabolism, standing 12 hours . . . .	0.8733 $\pm$ 0.0308	0.8710 $\pm$ 0.0313
Basal catabolism, standing 24 hours . . . .	0.8548 $\pm$ 0.0350	0.8250 $\pm$ 0.0415

Computing the basal catabolism per square metre of body surface as estimated by MOULTON's formulae viz.,

$$\text{For unfattened animals } S = 0.1185 W^{\frac{5}{8}}$$

$$\text{For fattened animals } S = 0.158 W^{\frac{5}{9}}$$

the following results were obtained:—

*Basal Catabolism of Cattle per Square Meter of Body Surface.*

	Lying 24 hours	Standing 12 hours	Standing 24 hours
Mean, calories . . . . .	964.0	1173.0	1365.0
Probable error of mean, calories	$\pm 24.0$	$\pm 21.4$	$\pm 25.7$
Probable error of single result, calories . . . . .	$\pm 124.8$	$\pm 110.9$	$\pm 133.6$
Standard deviation, calories . . . . .	185.1 $\pm$ 17.0	164.5 $\pm$ 15.1	198.0 $\pm$ 18.2
Coefficient of variability . . . . .	0.1920	0.1462	0.1451

A positive correlation of the basal catabolism per square metre of body surface with the live weight was also found as follows:—

*Coefficients of correlation with live weight.*

Basal catabolism per square metre

Lying 24 hours . . . . .	0.5375 $\pm$ 0.0923
Standing 12 hours . . . . .	0.3666 $\pm$ 0.1124
Standing 24 hours . . . . .	0.2405 $\pm$ 0.1223

The results show the marked influence of standing upon the metabolism of cattle, the mean 24 hour basal catabolism lying, standing 12 hours and standing 24 hours being in the proportion of 100 : 121 : 141, the differences largely exceeding the probable errors. Computing, from the results per square metre of surface, the basal catabolism for 12 hours' standing and 12 hours' lying gives as the maintenance requirement for a 1000 pound steer  $5918 \pm 560$  calories.

The results for the basal catabolism of man reported by BENEDICT, EMMES, ROTH and SMITH, and by MEANS are very similar to those obtained by the authors upon cattle with the exception of a much lower variability.

### *Coefficients of Correlation*

	With body weight	With body surface
Total basal catabolism:		
98 men . . . . .	$0.7263 \pm 0.0320$	$0.7747 \pm 0.0272$
75 women . . . . .	$0.7759 \pm 0.0310$	$0.7447 \pm 0.0347$

### *Daily Basal Catabolism of Men and Women per Square Metre of Surface.*

	Men	Women
Mean calories . . . . .	830.0	768.0
Probable error of mean, calories . . . . .	$\pm 4.3$	$\pm 4.9$
Probable error of single results, calories . . . . .	$\pm 42.3$	$\pm 42.8$
Standard deviation, calories . . . . .	$62.7 \pm 3.0$	$63.5 \pm 3.1$
Coefficient of variability . . . . .	0.0755	0.0827

Correcting for the error shown by D. and E. F. DU BOIS to be incident to the use of the MEEH formula, the means for men and women are as follows —

### *Corrected Daily Basal Catabolism of Men and Women per Square Metre of Body Surface.*

	Men	Women
Means, calories . . . . .	935.0	886.0
Probable error of mean . . . . .	$\pm 4.8$	$\pm 5.8$
Probable error of single result . . . . .	$\pm 47.5$	$\pm 49.4$

Including the data obtained by MEISL, STROHMER & LORENZ, TANGL, FINGERLING, KÖHLER & REINHARDT for swine and by ZUNTZ and HÄGERMANN for the horse, the following comparison of species may be made :

*Mean Daily Basal catabolism per Square Meter of Body Surface.*

Men (complete muscular rest) . . . . .	935 ± 5
Women (complete muscular rest). . . . .	886 ± 6
Cattle (lying). . . . .	964 ± 24
Hogs (lying). . . . .	1078 ± ?
Horse (standing quietly) . . . . .	948 ± ?

Considering the nature of the results they show a rather striking degree of uniformity and tend to confirm the conclusions of E. VOIT that the basal catabolism of different species of animals is substantially proportional to their body surface. It may be surmised that the exceptional result with the hog is due to the imperfect data available for computing the body surface of this species.

546 - **Adenine and Guanine in Cow's Milk.** — VOEGTLIN, CARL and SHERWIN, CARL P. (Division of Pharmacology, Hygienic Laboratory, Washington), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 1, pp. 145-149, Bibliography of 3 Publications. Baltimore, Md., January, 1918.

In the course of some work on the isolation of the antineuritic substance present in cow's milk, the authors incidentally discovered that this food contains fair amounts of adenine and guanine. One litre of milk contains at least 5 mgm. of adenine and about 10 mgm. of guanine. These values may be considered as minimum values, as the method of isolation of these amino-purines is by no means quantitative. The question as to whether the purines found in milk are derived from the blood purines or whether they are formed from the breaking down of the nucleic acid in the mammary gland is still left open.

The finding of the writers is of interest in connection with the biochemistry of milk for the following reasons: 1) milk is usually considered to be practically purine-free and has been widely used in metabolism experiments as a purine-free diet; 2) milk was used as a diet in experiments to determine whether or not the animal body can synthesize purines and nucleic acid from purine-free food; 3) under certain conditions the mammary glands may act as an excretory organ for metabolism products, drugs, and poisons.

547 - **The Nature of the Dietary Deficiencies of the Oat Kernel.** — MCCOLLUM, E. V., SIMMONDS, N. and FITZ, W. (Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXIX, No. 2, pp. 341-354 + 9 Diagrams. Baltimore, Md., March, 1917.

FEEDS  
AND FEEDING

In this paper the writers present data showing the supplementary relations between the oat kernel and isolated food factors. The experiments were made with rats. The results may be briefly summarized as follows:—

The oat kernel seems to contain proteins of a poorer quality than either the maize or wheat kernel. 9 per cent of oat proteins serve, when all the other dietary factors are properly adjusted, to induce a small amount of growth at the beginning of the experiment, but cessation of growth always follows after about a month and thereafter the animals remain stationary in weight, or decline.

Casein does not appear to supplement the proteins of the oat kernel in a very satisfactory manner. The addition of 10 per cent of casein to 9 per cent of oat proteins, the other dietary factors being properly adjusted, does not induce growth at the maximum rate as do similar combinations of casein with wheat proteins or with maize proteins. Combinations of gelatin and oat proteins in about equal proportions have uniformly proved vastly superior to the similar casein and oat protein combinations.

The unidentified dietary factor, fat-soluble A, is present in very small amount in the oat kernel. It is not possible to supplement the oat kernel with inorganic salts and purified protein so as to induce growth beyond the 3rd month. The inclusion of butter fat or some other substance which supplies the unknown A prevents failure at this point, just as it does in experiments where the ration consists of purified protein salts, carbohydrate, and an extract which furnishes the dietary factor B.

The whole oat kernel, with the hulls removed in the laboratory by coarse grinding and fanning, will not induce any growth in young rats. A mixture of hulled oats or rolled oats with 5 per cent of butter fat induces very slow increase in body weight for at least 125 days.

The oat kernel, like unpolished rice, wheat, wheat germ, maize kernel, alfalfa leaves, cabbage, and clover leaves, contains a liberal supply of the water-soluble B, the preparations of which induce relief from polyneuritis. The authors found this dietary factor in abundance in all the natural food-stuffs in a fresh condition, so far as they employed them in experimental work.

The addition of any single dietary component as protein, inorganic salts, or fat-soluble A does not supplement the oat kernel so as induce appreciable growth.

The addition of two dietary factors to the oat kernel serves to induce good growth during the first 60 days when one of the additions is a suitable salt mixture. Without modifying the inorganic content of the ration when this is derived solely from the oat kernel, the authors have not seen rats make any marked increase in body weight. When the oat kernel is fed supplemented by but two dietary factors there is always early failure with loss of weight and death following the brief period of growth.

Failure has, in the writers' experience, supervened earlier than when wheat or maize is fed with the addition of two purified food additions. The oat kernel, like the wheat kernel, appears to cause injury to the animals when their diet is of such a character as to lower their vitality. It is not necessary to assume the presence of something toxic in the oat kernel to account for the injury which results from the presence of a high content of oats in a monotonous food mixture taken over a considerable period. Oats produce faeces of a pasty character which makes their elimination difficult, and in all probability tend to debilitate the animal.

This explanation becomes the more plausible when we consider the marked improvement of rats whose rations were identical except that the proteins of the oats were in one case supplemented by 10 per cent of casein and in the other by 9 per cent of gelatin. There can be no doubt that gela-

tin furnishes an amino-acid mixture which makes good the deficiencies of the oat proteins in a much greater degree than does casein. The improved physiological condition of the animals which results from the superior quality of their protein mixture in the former case may render them capable of overcoming the difficulty of elimination of faeces. If this is the real explanation the stunting observed with the oat-casein combinations may be due to the absorption of the products of putrefaction from the intestine.

When the oat kernel is supplemented with casein, a suitable salt mixture and butter fat, growth may proceed to the normal adult size at the normal rate in some animals, but, in general, growth is slower than the normal rate. The authors have been able to secure reproduction with these rations in but a single instance, and the young survived but 1 day.

**548 - Feeding Experiments on the Substitution of Protein by Definite Mixtures of Isolated Amino-Acids.** — MITCHELL, H. H. (Department of Animal Husbandry, University of Illinois, Urbana), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 1, pp. 231-261 2 Tables 5 Diagr. Baltimore, Md. August, 1916.

The writer summarizes as follows the chief results of his researches :

Experiments are reported in this paper in which mice have been kept alive for 70 to 98 days by feeding alternately : — 1) rations containing 4 to 6 per cent of various mixtures of isolated amino-acids, 6 to 4 per cent sucrose, 34 per cent starch, 28 per cent protein-free milk (prepared either according to the procedure of OSBORNE and MENDEL or to a modification of this procedure described in the text), 10 per cent lard, and 18 per cent butter fat, and 2) a ration containing 10 per cent sucrose, with other constituents in the same proportion as in the first mentioned rations. In many of these experiments periods of 15 to 35 days' duration have been observed in which the mice practically maintained their weight.

The alternate feeding of an amino-acid ration and a non-nitrogenous ration (except for the nitrogen present in the protein-free milk) induced a better total consumption of food than feeding with an amino-acid ration alone, and in all other respects led to more successful results. However, it is probable that in no case was the amino-acid intake sufficiently large to assure a fair test of its adequacy.

Amino-acid rations containing no added tyrosine, or no added tyrosine and phenylalanine, did not give appreciably different results from rations containing these amino-acids. However, if tryptophane was absent from an amino-acid ration, the period of survival of mice fed this ration alternately with the non-nitrogenous ration was noticeably shorter than the periods of survival of mice kept on rations containing added tryptophane.

Mice could be kept for much longer periods of time on rations containing mixtures of amino-acids, including tryptophane, fed alternately with the non-nitrogenous basal ration, than when fed the basal ration alone. Furthermore, this difference in survival cannot be accounted for by a difference in energy intake. This fact has been interpreted as meaning that at least some of the amino-acids have specific functions in metabolism aside from that of serving simply as material for the synthesis of body protein. Other

evidence from the literature is cited in support of this view, which is substantially the same as that recently and tentatively put forward by OSBORNE and MENDEL (*Journal of Biological Chemistry*, Vol. XX, p. 377, 1915).

549 — **Fat Assimilation.** — BLOOR, W. R. (Laboratories of Biological Chemistry of the Harvard Medical School, Boston), in *The Journal of Biological Chemistry*, Vol. XXIV, No. 4, pp. 447-460. Baltimore, Md., 1916.

The author has made determinations of total fat; lecithin (phosphatides) and cholesterol in whole blood and plasma (and by calculation in the corpuscles) during a series of fat absorption experiments, carried on with dogs, with results which are believed to justify the conclusions: 1) that the blood corpuscles take up the fat from the plasma and transform it into lecithin; 2) that most if not all of the absorbed fat is so transformed; and therefore 3) lecithin is an intermediate step in the metabolism of the fats.

#### CATTLE

550 — **The "Optimum Age" for Fattening Off Irish Bullocks.** — WILSON, J., in the *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XVIII, No. 1, pp. 3-6. Dublin, 1918.

The majority of Irish calves are born in spring. For the first couple of weeks they are fed upon whole milk, and then upon meals and separated milk for the rest of the summer. They are then "stored" till they are from 18 to 42 months old, but, in the majority of cases till they are 30 months old. During the first winter of storing they are fed hay, a couple of stones of roots or a couple of pounds of cake, and pasture. During the second winter they depend chiefly on pasture, with some hay or straw, and, in some cases, a few roots. Only pasture is given the third winter though, in very severe weather, a little hay or straw is added. Under these conditions growth is slow and in autumn the bullocks usually require a month's preparatory feeding before being put upon a fattening ration. Their approximate average weight and their selling value (1) per head at different ages are: at birth 70 lb. £2.5s. ; at 6 months, 3 cwt., £4 15s. ; at 12 months, 4 cwt., £6.10s. ; at 24 months, 7  $\frac{1}{4}$  cwt., £11.10s. ; at 36 months, 10 cwt., £15.10s. ; at 42 months, 11  $\frac{1}{4}$  cwt., £17.10s. Therefore the selling value per pound live-weight of the dropped calf falls from 7.7d. to 3.4d. a pound in about 6 months; after this the variation is slight. If the weight of the new born calf is reckoned at 70 lb. and the drop in value at 4  $\frac{1}{2}$ d. a pound, the total loss is 26s. 3d.; a loss which must be wiped out before any profit can be realised. During the rearing period the calf gains about 1  $\frac{1}{2}$  lb. a day, which, with a selling value of 3.4d. a pound, is roughly equivalent to a daily increase of 5d. in money value. If it can be reared at 3d. a day the loss of 26s. 3d. will be discounted in about 5 months. The rearer cannot, therefore, sell a calf profitably till it is 6 months old unless he gets more than 3.4d. a pound for it.

A medium sized fattening bullock puts on about 2 lb. a day, at a cost of about 11d. (i. e., 5  $\frac{1}{2}$ d. a pound), and is sold at 4d. a pound. The loss of 1  $\frac{1}{2}$  lb. a pound is, however, only apparent, being compensated for by the rise in

(1) All prices in this paper are average pre-war prices.

Periods of Fattening	Costs	Finished live Weight	Cost of Pro- duction per pound
		cwt.	d.
12 months old to 17 months (grass fattened)	Cost of Store Bullock at 12 months . . . . . Young Pasture and Clover aftermaths. . . . . Cake, 2 lb. a day for one month and 3 lb. for three = 330 lb. . . . . Attendance for six months . . . . . Risk at 2 ½ % . . . . . Interest on Capital at 5 % . . . . .	\$ 6.10.0 2. 0.0 1. 4.0 0.10.0 0. 4.9 0. 4.0	6 ½ 3.5
18 months old to 22 months (Winter fattened)	Cost of Store at 18 months . . . . . Hay, 7 lb. a day for four months = 60 stone . . . . . Straw, 3 ½ lb. a day = 30 stone . . . . . Roots, 56 lb. a day = 3 tons . . . . . Cake and Grain, averaging 4 ½ lb. = 4 cwt . . . . . Attendance for four months . . . . . Risk at 1 ½ % . . . . . Interest on Capital . . . . .	10.12.9 9.10.0 0.16.10 0. 5.9 1.10.0 1.13.0 0. 7.6 0. 3.0 0. 4.0	8 ¾ 3.58
	Less Manure . . . . .	14.10.1 0.12.0	
21 months old to 24 months (Winter fattened)	Cost of Store at 21 months . . . . . Hay, 7 lb. a day for 90 days . . . . . Straw, 3 ½ lb. a day . . . . . Roots, 70 lb. = 56 cwt. . . . . Cake and Grain, 41 lb. = 3 ¾ cwt . . . . . Attendance . . . . . Risk at 1 ¼ % . . . . . Interest on Capital . . . . .	13.18.1 11. 5.0 0.12.6 0. 5.0 1. 8.0 1. 1.2 0. 6.6 0. 2.0 0. 3.6	8 7/8 3.55
	Less Manure . . . . .	15. 3.10 0. 9.0	
24 months old to 30 months (Grass fattened)	Cost of Store at 24 months . . . . . Pasture . . . . . Cake and Corn, 4 lb. a day for three months = 3 ¾ cwt. . . . . Attendance for six months . . . . . Risk at 1 % . . . . . Interest on Capital . . . . .	14.14.10 11.10.0 2. 5.0 1. 1.2 0. 7.6 0. 2.6 0. 6.6	9 ½ 3.53
30 months old to 34 months (Winter fattened)	Cost of store at 30 months . . . . . Hay, 7 lb. a day for four months = 60 stone . . . . . Straw, 7 lb. a day = 60 stone . . . . . Cake and Grain, averaging 4 lb. a day for 3 months = 3 ¾ cwt. . . . . Roots, 84 lb. a day = 90 cwt. . . . . Risk . . . . . Interest on Capital . . . . .	15.12.8 14. 5.0 0.16.10 0.11.6 1. 1.2 2. 5.0 0. 3.3 0. 8.6	19.11.3 0.14.0
	Less Manure . . . . .	18.17.3 15.10.0 2.10.0 1. 1.2 0. 7.6 0. 3.6 0. 8.6	11 3.67
36 months old to 42 months (Grass fattened)	Cost of store at 36 months . . . . . Pasture . . . . . Cake and Corn, 4 lb. a day for three months = 3 ¾ cwt. . . . . Attendance for six months . . . . . Risk . . . . . Interest on Capital . . . . .	20. 0.8 17.10.0 0.16.10 0.11.6 1. 1.2 3. 0.0 0. 3.9 0. 7.6 0.10.6	24. 1.3 0.15.0
	Less Manure . . . . .	23. 6.3.	12 ¾ 4

value of every pound of the original lean animal from 3.3*d.* to 4*d.*, but this size animal realises no profit.

From the time the rearer can afford to sell it till the time the fatterer buys it, the Irish bullock is stored, the period of storing lasting from 1 to 3 years. Since the main function of a store bullock is to convert the more or less unmarketable products of the farm into something which can go to market on its own feet, the owner will naturally prefer an animal suited to the fodder produced on the farm and not too advanced in growth, its age being of secondary importance. There is, however, an age at which the bullock can be put up to be fattened to the best advantage; this age is when the difference between the total gain produced by improving the unfattened weight and the outlay upon fattening foodstuffs is at its maximum. This can be determined by estimating the cost of producing a pound of beef with bullocks of different ages. The appended table shows the estimated pre-war costs of producing beef at different ages (page 591).

As grass in Ireland is cheaper than winter foods, the grass fattened bullock costs less to produce. It is seen, however, that, in both cases, the producer's profits begin to decline if the bullock is not fattened off while it is about 2 years old or under. A bullock stored till it is 3½ years old makes no profit, and if such an animal is sold to be fattened, it is clear that if the fatterer makes a profit on it the seller makes a corresponding loss.

**551 - Breeding Hens for Egg Production (1).** — MURPHY, L., in the *Journal of the Department of Agriculture and Technical Instruction for Ireland*, Vol. XVIII, No. 1, pp. 33-48. Dublin, 1918.

The paper under review gives the results of the 5th Irish Laying Competition held, as in previous years, at the Munster Institute, Cork, and the conclusions deduced from them.

The competing breeds included 17 pens of White Wyandottes, 6 of Rhode Island Reds, 5 of White Leghorns, and one each of Black Minorcas, Red Sussex, and Buff Orpingtons. There were, in addition, 4 non-competing pens. Each pen contained 6 pullets.

The dearth of eggs in Ireland in October and November is due to late hatching, heavy breeds hatched in May being useless for winter egg production. The tests showed that with very good laying strains, as, for example, certain families of white Leghorns, late hatching is fairly successful if the feeding and general management during the growing stage are good. The eggs of early hatched pullets are, however, of better size than those of late hatched ones, an important factor when dealing with breeds having a tendency to lay small eggs. Until recently little attention was given to the size of the eggs, though failure to give good sized produce is so serious a fault that it discounts any other merit a strain may have. Good size and large production can be successfully combined but good stock must be used, all hens laying second-grade eggs being rigorously excluded. From the results of these tests it seems that when a pullet has laid a large percentage of small eggs in her first year, but gives good-size eggs about August of

(1) For Report of the 3rd competition see R. May, 1916, No. 542. (*Ed.*)



her first season (*i. e.*, at the beginning of her autumn laying cycle), her female progeny are liable to do the same. It is, therefore, wiser not to use such a hen for breeding, even though her pullet record be far above the average and her eggs in the second year 2 oz. or over. To obtain the best results accurate breeding records and careful selection are essential. So-called "line breeding" cannot be continued successfully over a number of years unless the parentage of every bird in the breeding pens is known.

Too much care cannot be taken in the choice or a cockerel to mate with layers, and special consideration should be given not only to the number, but also to the size of the eggs laid by his dam. The high price paid for such a bird will be amply repaid by the results obtained.

The increase in broodiness in some strains has not yet been definitely explained. In some cases when a non-broody pullet is mated with a cockerel from a non-broody hen, all the progeny will be broody. The most satisfactory explanation is that given by Mr. OSCAR SMART, who suggests that broodiness is due to the presence of two factors, A and B. A pullet inheriting the factors AA or BB will not go broody, but if a bird inheriting AA is crossed with one inheriting BB all the progeny will be broody at some time or other. All that can be advised at present is that a cockerel which has introduced broodiness should not be used again with the same hens.

The food given during the period of the tests included, in decreasing order of the amounts given:—oats, bran and pollard, potatoes, maize meal, wheat, fish meal, dried grains, gluten meal, dried yeast, small quantities of dry mash and concentrates, and greenstuff. Reducing the potatoes to their grain or meal equivalent, 4 lb. of potatoes equal 1 lb. of grain or meal, giving a total of 180  $\frac{1}{4}$  cwt. for the 210 birds, thus 4.31 lbs. of meal were required to produce 1 lb. of eggs. As a large percentage of this meal was unfit for human consumption it showed the hen to be very profitable for the conversion of such food into a rich and easily digested human food. The free use of potatoes was perfectly satisfactory when balanced by a highly concentrated food, such as fish meal. When, as at present, prices are high, it is far better policy to feed a few birds liberally than to keep a large number on little more than a maintenance ration, for, as such birds are very poor for table and useless for egg production, the result is sure to be a loss.

The winning pen (White Wyandottes) laid 1 339 eggs, or an average of 223.2 per hen; the maximum number laid by one hen was 251. The following table gives the general results of the competition compared with those obtained in previous years.

Year	No. of pullets	No. of eggs laid	
		Total	Average per hen
1913 . . . . .	318	38 199	120.1
1914 . . . . .	282	39 216	139.0
1915 . . . . .	264	39 764	150.6
1916 . . . . .	294	49 830	169.5
1917 . . . . .	210	36 660	174.6

552 - The Behaviour of Chickens Fed Rations Restricted to: — I) Cereal Grains; II) Wheat or Maize Kernel. — I. HART, E. B. HALPIN, J. G. and McCOLLUM, V., in *The Journal of Biological Chemistry*, Vol. XXIX, No. 1, pp. 57-67 + 2 Tables + 1 Plate. Baltimore, February, 1917. — II. HART, E. B., HALPIN, J. G., and STERNBOCK, H., *ibid.*, Vol. XXXI, No. 2, pp. 415-420 + 1 Plate, August 1917.

Wheat is generally considered to have a higher food value than other cereals. The numerous experiments carried out on mammals by the authors since 1911 tend to prove the opposite and show almost beyond doubt that wheat contains a slightly toxic material. Moreover, wheat proteins are of inferior quality, and may partly account for the malnutrition observed by the authors when wheat was fed in excessive quantities. The fact that maize kernel proteins are equally inferior for growth but are not otherwise unsuitable for normal nutrition points to the great probability that the lower food value of the wheat kernel is due to one or more toxic substances. The authors, therefore, undertook experiments with chickens to determine: — a) their resistance to an exclusive or restricted diet; b) their food requirements.

I. — Feeding experiments carried out with strong Rhode Island Red hens weighing from 3 to 4 lb., fed exclusively on cereals and their derivatives during 7 to 12 months, showed that chickens started at half the normal weight can grow slowly, maintain themselves, and produce fertile eggs on rations limited to: — 1) maize meal + gluten feed + calcium carbonate, or 2) wheat meal + wheat gluten + calcium carbonate.

These results are in marked contrast to those obtained by the authors with swine and rats, in which these rations led to loss of weight, cessation of oestrus, and, with wheat, to a condition resembling polyneuritis.

The mineral requirement, and probably also that of other normal nutritive factors, is not the same for chickens as for mammals. Moreover, the fowl's capacity to tolerate without fatal results or a modification of diet, the toxic substance contained in wheat, shows its metabolism to differ from that of swine or rats.

When half-grown chickens were used in the experiments no important improvement was obtained in the rate of growth or egg-laying capacity by supplementing the grain with salts, casein, butter fat, or a mixture of the three, as compared with the results obtained with grain + grain protein concentrate + calcium carbonate. The protein content in all cases was about 12 %. The eggs produced on all these rations though fertile were few.

This result, which disagrees with the best practical results in which animal protein concentrates have proved of great value as supplements to a ration of cereal grains for egg production, suggests that either the higher plane of protein intake (20-25 %) obtained in practice by the use of the animal protein concentrates (meat scraps, milk, etc.) would account for this difference, or else these concentrates contain certain factors necessary to a large egg production which are not found in the cereal grains or casein.

II. — The previous experiments were extended to younger chickens weighing from 2 to 3 lb., with the following results: —

Chickens started below half their normal weight can grow slowly and maintain themselves on rations restricted to maize meal, gluten feed, and calcium carbonate. A ration restricted to wheat grain, wheat gluten and calcium carbonate causes death in 3 months. These results agree with those obtained for mammals, especially with regard to the action of wheat grain.

When compared with the results given above, these show a difference in the behaviour of more mature and younger chickens. The former tolerate wheat, but the latter, like adult or young mammals, succumb to a diet containing excessive wheat. There is also a difference in the mineral requirements of growing chickens and growing mammals.

Modifying the wheat grain by the addition of a complex salt mixture, or by this mixture and another change, such as substituting casein for part of the wheat protein, does not improve the dietary properties of wheat for young chickens. Only when butter is added and the salt mixture and casein substituted for part of the wheat protein are tolerance and good health obtained.

These results do not imply that wheat or its derivatives cannot be fed to growing chickens or mammals, but only show their dietary limitations with another species. They also prove that wheat cannot be successfully used as an exclusive diet for young chickens without the introduction of other dietary factors, and show what these factors are.

**553 - Studies on the Physiology of Reproduction in the Domestic Fowl.** — PEARL, RAYMOND (Maine Agricultural Experiment Station, Orono), in *The Journal of Biological Chemistry*, Vol. XXIV, No. 2, pp. 123-135. Baltimore, Md., 1916.

In the preceding paper in this series (1) the author has shown that the injection of the substance or extract of the anterior lobe of the pituitary body into the peritoneal cavity of the domestic fowl failed entirely to activate the completely resting ovary. These negative results seemed to make attempts at administration *per os* worth while. The results may be summarized as follows:—

Feeding the desiccated substance of the anterior lobe of the pituitary body of cattle to hens in laying condition but at a time of year when the rate of fecundity is declining, does not stimulate the ovary to an increased rate of production.

Feeding the same substance to growing pullets does not bring about any earlier activation of the ovary than occurs in normal control pullets not fed this substance.

The anterior lobe of the pituitary body from cattle when fed to growing chicks is accompanied by a distinct retardation in growth in body weight. This confirms for the chick the results which have been obtained with this substance by other investigators (CUSHING, SANDRI, ALDRICH) in mammals.

The feeding of the desiccated substance of corpus luteum brings about a retardation of growth about twice as great in amount as that following pituitary feeding.

(1) See B. August 1915, No. 838. (Ed.)

Neither pituitary substance (anterior lobe) nor corpus luteum substance when fed to laying pullets causes any retardation in the attainment of sexual maturity as indicated by the laying of eggs. The birds so fed begin to lay eggs at the same age, but at a smaller body weight than the normal controls.

## FARM ENGINEERING.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

554 — **State Motoreculture in England and Scotland.** — I. *Mask Lane Express Agricultural Journal*, Vol. CXIX, No. 4505, p. 88. London, January 28, 1918. — II. *The Scottish Journal of Agriculture*, Vol. I, No 1, pp. 61-62. Edinburgh, January, 1918.

I. The President of the Board of Agriculture has stated that the area ploughed by Government tractors from the middle of August to January 12, 1918, was 231 000 acres. On the latter date there were 1 813 tractors working.

II. — The Food Production Department of the Board of Agriculture and Fisheries acquired a large number of tractors, one seventh of which were allotted to the Scottish Board. This quantity, however, was not required, and only 115 new tractors were added to the previous year's total. These were of the following types: — Titan, Overtime, British Universal, Moline, Wallis, Cub Junior, and Burford-Cleveland.

Considerable difficulty was experienced in providing ploughs for these tractors to suit Scottish conditions. The ploughs brought by the Scottish Board were mostly made by Messrs. SELLAR & SON (Scotland) and OLIVER (United States). One SANDERSON & MILL plough and one CASE plough were bought.

Grubbers, cultivators and harrows will also be provided for use with the tractors.

555 — **Agricultural Machinery in Italy.** — ALPE, V., in *L'Industria*, Vol. XXXII, No. 4, pp. 99-100, 4 Figs. Milan, February 28, 1918.

Of late years great progress has been made in Italy in the construction of agricultural machinery.

The writer first describes a turnwrest plough, with an all-metal frame, for hill work, and built entirely in Italy. Its sale price is 1 ½ francs per kg. (instead of ½ a franc—the pre-war price). Large numbers of a plough with the mouldboard carried on front wheels, somewhat like the Belgian plough, are being constructed. Two models can now be delivered, one working at 16, the other at 12 in. deep. They were tested with a draw-bar pull of 60 kg. per sq. millimetre.

The writer also mentions the construction of a seed drill of the American type and of a chop-cutter, both machines much in demand in Italy. Two types of chopcutter are made in Italy: — one with a 12 in. delivery, with round gear wheels, giving 5 different lengths of cut, and with a chain that delivers the forage automatically to the knives; it weighs 175 kg; the other type is simpler, but without an automatic feed. The knives are also of Italian make.

556 — **Energy Required in Cultivation.** — RINGELMANN, MAX, in the *Journal d'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 4, pp. 66-69, 5 Charts + Tables. Paris, February 21, 1918.

While studying, in 1898, cultivation work in the very fertile soils belonging to the upland silt resting on the tertiary clay of the Coupvray farm, France, the author found that the preparation of the soil for beet after cereals required nearly 8 times more energy than is required in the same soils for winter wheat after beet.

The author calculates that the cultivation of 1 hectare requires, according to the period in the rotation from 7 to 55 million kilogrammetres, which have to be furnished by the farm teams during a time which is always limited (1).

Elsewhere, on tertiary soils where the method of cultivation is different, the author found just over 8 million kilogrammetres for the cultivation of 1 hectare to carry winter wheat after beet, and nearly 39 ½ million kilogrammeters for beets after cereals; the divergences from the figures obtained at Coupvray are mainly due to the machinery employed, as well as to the depth of the ploughing and scarifying.

Ploughing represents the greatest part of this total expenditure of energy the division of which among the different operations is shown in Table I.

TABLE I. — *Repartition of the Total Expenditure of Energy amongst the Various Operations.*

	Breaking-up stubble	Ploughing at 5 to 6 in.	Ploughing	Ploughing at 10 in.	Harrowing	Scarifying	Rolling	Total
	kg.	kg.		kg.	kg.	kg.	kg.	kg.
Preparation of a soil for winter wheat after beet . . . . .	—	680	—	—	130	—	—	810
<i>Idem</i> for beet after cereals	530	—	at 6 in. 830	1 500	460	460	160	3 940
<i>Idem</i> for spring oats. . . .	—	—	from 7 to 8 in. 1 100	—	200	250	80	1 630
Clearing off 3-year clover for a winter cereal . . .	—	—	1 300	—	230	—	80	1 610
Clearing off clover for a winter cereal . . . . .	—	—	1 400	—	240	—	80	1 720

These figures show the average traction in kg. per metre of width worked; to obtain the energy necessary per hectare in kilogrammetres, each average tractive effort must be multiplied by 10 000

(1) These figures would be greater for stronger soils. For the whole work, the energy should be added that is required for carting and spreading manure and fertilisers, sowing, cultivation, harvesting and carting.

For a winter cereal after potatoes the figures are very close to those for winter wheat after beet

Table I shows that ploughing represents, according to the case, 8, 72, 67, 80, and 81 % of the total energy required for the various preparatory operations for these soils. In this way is found the cost of ploughing in comparison with that of other operations. Starting from the fact ascertained on the farm under consideration, that in November a team of 3 good horses ploughed 3.4 ares at 7 to 8 in. deep in a day of 9 hours' actual work, the author deduces the approximate area cultivated per day for the different operations and the number of actual hours of work required for cultivating 1 hectare, as shown in Table II.

TABLE I. — *Area Worked per Day and Time Required per Acre*

	Area worked per day ares	Time required per hectare hours and tenths	
<i>Preparation of a soil for winter wheat after beets</i>			
Ploughing at 5 in	55	16.4	
Harrowing	288	3.1	
<i>Total</i>		<b>19.5</b>	<b>19.5</b>
<i>Preparation of a soil for beet after wheat</i>			
Breaking up stubble	70	12.9	68.9
Ploughing at 6 in	15	20.0	
Ploughing at 10 in	25	30.0	
Harrowing	187	4.8	26.0
Rolling	468	2.0	
Scarifying	163	5.5	
Harrowing	248	3.1	
Scarifying	163	5.5	
Harrowing	288	3.1	
Rolling	468	2.0	
<i>Total</i>		<b>94.9</b>	<b>94.9</b>
<i>Preparation of a soil for spring oats</i>			
Winter ploughing at 7 to 8 in	51	26.5	26.5
Scarifying	150	6.0	10.5
Harrowing	187	4.8	
Rolling (in certain cases)	168	2.0	2.0
<i>Total</i>		<b>39.3</b>	<b>39.3</b>
<i>Cleaning off 3 year clover for winter cereal</i>			
Ploughing at 7 to 8 in.	29	31.0	31.0
Rolling	168	2.0	7.5
Harrowing	168	5.5	
<i>Total</i>		<b>38.5</b>	<b>38.5</b>
<i>Cleaning off lucerne for winter cereal</i>			
Ploughing at 7 to 8 in	27	33.5	33.5
Rolling	468	2.0	7.5
Harrowing	156	5.8	
<i>Total</i>		<b>41.1</b>	<b>41.1</b>

The data of Table II are in agreement with current practice.

557 — **The Agricultural Tractor: Some Factors Governing the Design of a Small Tractor** (1). — CHORLTON, A. E. I., in *Engineering*, Vol. CV, No. 2714, pp. 7-10, Fig. 12, Tables 2. London, January 1, 1918.

The problem of providing mechanical power in the most suitable and efficient form for the purposes of agriculture, is one of no inconsiderable difficulty, the guiding factors being such variables as the size of the farm, the class of land, the nature of crop, road transportation and the financial ones of first cost, annual charges, etc. Owing to lack of precise information the author has had to provide much of the essential data by actual experiments, the results of which are of great value for all those interested in the agricultural tractor.

After having discussed and compared the advantages and disadvantages of a special power implement for each purpose with those of a multi-purpose machine, the author concludes that the financial consideration of the problem brings out the advantages of a multi-purpose machine, but without necessarily excluding special machines. There will always be farms so large or special conditions of such a nature as to allow of the purchase of special machines. The 3 chief uses which, by their requirements, govern the design of the tractor are: — a) Road work, which governs the minimum axle loading; b) Land work, which governs the maximum axle loading; c) Farmstead, which governs the minimum power required.

**ROAD WORK.** — The basic factors are adhesion and resistance. The adhesion of the driving wheels on the road must be sufficient to utilise the power developed by the engine in overcoming the tractive resistance of the load and the tractor combined. There exists a considerable amount of data relating to tractive resistance, but for tractive adhesion on common roads, little can be found. For traction on rails recognised constants have been developed from abundant data. The standard figure of adhesion is 0.25, i. e., one-quarter of the load on the driving axles can be used in drawbar pull. After a detailed consideration of adhesion and resistance the author gives the results of his test in 2 diagrams, which will be of great use for tractor construction.

**WORK ON THE LAND.** — The pressure which worked land will bear without injurious effect on the crops, varies according to the nature of the soil. From the mechanical point of view the limit of pressure is set by the necessity to prevent sinking into the ground, an occurrence which is seldom due to excessive weight. What usually happens is that owing to inadequate gripping power the driving wheels rotate and act as milling cutters, scraping out the soil from underneath. The relative values of weight and spud area are very difficult to allocate so as to be able to make comparisons. For instance, a machine with a 30-cwt. axle loading and short spuds pulls partly by adhesion and partly by grip, the latter being rendered more effective by the weight of the wheel holding the ground down during this action. A lighter tractor with a 15-cwt. axle loading must pull very largely by grip alone and the effectiveness of the grip is modified and reduced by the lighter weight

(1) Paper read before the Institution of Automobile Engineers, London.

behind it, and the greater rolling resistance per ton set up by the spuds. The factors to be determined are, therefore, the proper relation of pressure on the land, the pressure against it, and the action of the rim projection, strake, spud or grouser. In most cases 3 conditions must be met: — *a*) driving axle loading; *b*) pressure against grips or spuds; *c*) effect of rolling resistance. On examining these conditions the author finds that, for light lands, the spud must be increased 4 times, as compared with heavier land. Many useful experiments could be carried out to determine the most efficient form of grip for varying conditions of soil and weight of tractor. On very soft land the wheeled tractor, either by reason of weight or spud pressure, is not suitable, and one of the caterpillar type becomes essential.

**WORK ON THE FARMSTEAD.** — The highest power required is for threshing, which according to the author's diagram, does not exceed 20 HP., though it is usual to allow 25 HP for large machines.

The appended table summarises the results of the author's experiments and shows the basic requirements for a multi-purpose tractor.

	Power required HP.	Driving axle loading Lb.
Road work . . . . .	18—20	4 400
Land work . . . . .	23—25	4 400
Farmstead . . . . .	20—25	Stationary

In considering the engine, the conditions should be taken into account under which it has to run on a farm, the inexpert attention likely to be given to it being an important factor. Generally, while this requires robust construction, it also calls for a low power rating or a considerable reserve of power, and probably the factors of low speed, large cylinder capacity for power required, strength and simplicity of parts are the main ones. The engine *must* operate on paraffin, and it should be able to develop its power without water injection. Such an engine running on paraffin would give an economy of 30 %. It should, however, be quite possible to secure better economies with the ordinary engine than are at present customary. It may be taken that the consumption per acre in practice is about 3 gallons. A 20-HP tractor has probably about 12  $\frac{1}{2}$  brake-HP. Taking 2 hours per acre, this gives 12 pints per hour, or 0.96 pint per brake horse-power. This result is not at all a bad one, and is probably much better than when the tractor is run by an ordinary farm hand in daily work. The consumption might well be reduced to 0.85 pint per brake horse-power, or with a high-compression engine to 0.6 pint or even less.

The author suggests that the horizontal type of engine is to be preferred. The high speed engine reduces the weight of the tractor, but in view of the necessity of giving a reasonably long life under conditions of farm usage, it is debatable if this is a wise policy. The system of cooling chosen — radiator or tank system — depends mostly on local conditions.

The writer deals with the following points: — Frame; Gearing; Steering (there is a general tendency to adopt the double-pivot system for



tractor work) ; Wheels (which tend to be reduced in diameter, probably with a view to reduce weight) ; Land Grips. The caterpillar arrangement, whilst entirely suitable for special conditions on the land, cannot be considered as advisable for road work.

**558 - Improvements of Agricultural Implements in India.** — HENDERSON, G. S., in the *Agricultural Research Institute Punjab, Bulletin* No. 73, pp. 6 + 8 Plates. Calcutta, 1917.

The author describes several implements introduced by him into India and which are mostly modifications of implements in common use in Egyptian Agriculture likely to be useful in irrigated districts. The following are worthy of note : —

The Egyptian plough, provided with hardened steel shares and ridging attachment.

The scraper, for levelling irrigated land.

The threshing machine ; consisting of 3 axles each bearing 6 or 7 iron discs. The axles turn on iron bearings and the whole rests in an angle iron frame. The machine is pulled by a pair of bullocks and will thresh as much as 5 or 6 pairs of bullocks would tread out. The discs are kept sharp by filing. In working the grain is put in a heap on the threshing floor and a thin layer spread out on the circumference of the heap. The machine is pulled round this and the straw kept perfectly turned. Fresh material is gradually placed on the beaten layer until it is all beaten.

The author also describes 2 Archimedian screw water-lifts, as well as a Dutch water wheel. This latter is now used in Egypt, and Dr. PARR, of the United Provinces, gave the machine a trial and reported favourably on it.

**559 - Implements Used for Cultivating Rice in India.** — GILBERT, T., and SALIMATH, S. S., in *Department of Agriculture, Bombay, Bulletin* No 82 of 1916 (Cultivation of Drilled Paddy in South Bombay Presidency), pp. 9 + Fig. 23. Poona, 1917.

This bulletin, which deals with the cultivation of drilled paddy, contains 23 figures drawn to scale of the various native implements used in the South Bombay Presidency.

There is an extraordinary variety of implements in use for the cultivation of drilled rice. They are designed : — 1) to break the soil after harvest ; 2) to level the surface and at the same time to break clods ; 3) to reduce the soil to a fine seed bed ; 4) to sow the seed ; 5) to intercultivate and remove weeds ; 6) to puddle the soil and at the same time to remove weeds.

The different implements, together with their native name are briefly described below : —

- 1) bullock plough ;
- 2) the " kodda " and " kodati " for clod crushing ;
- 3) the " halka " brings clods to the surface ;

(1) The threshers now used in Persia consist of a square wooden frame, carrying 2 wood axles bearing iron discs. The machine described by the author constitutes a notable improvement, and would be very suitable to Persian conditions which do not allow of the use of modern agricultural machinery. (Ed)

- 4) the "kunti" for harrowing;
  - 5) the "doni" for levelling the soil;
  - 6) the "rool", a roller fitted with spikes;
  - 7) a 6 tyred seed drill, sowing 36 to 72 lb. of seed;
  - 8) the "henta" as a brush-barrow, after sowing;
  - 9) the "hutgunti", a 6-tynd hoe drawn by a pair of bullocks;
- in some parts the 2-tynd "yedikunti" is used;
- 10) the "repani" similar to the "hutgunti", but with the cutting edges of its blades rounded;

11) after the fields are flooded, the "ghute" is used for cultivating, levelling the surface, and uprooting shallow rooted weeds;

12) the "baskooti" is a wooden hand rake for collecting the weeds.

The crop is cut with a sickle and laid in rows in the field; it is threshed and handled by means of various native tools and implements.

**560 - The "Acrometer".** — *The Implement and Machinery Review*, Vol. XLIII, No. 515, pp. 1187-1188, Figs. 2. London, March, 1, 1918.

An instrument invented and placed on the market by Mr. W. G. GEORGE, Tunnel Hill, Worcester, England, to measure the acreage covered by tractor ploughs. The "Acrometer" measures from one 9-in furrow up to 6 furrows either 9 in. or 10 in. wide, and can be fitted to any plough in 10 minutes; whilst it will also register the work of other implements, such as mowers, binders, etc., up to 6 ft. wide or over.

The instrument will be very useful for measuring areas in tractor-ploughing tests. It costs £5.

**561 - Double Disc-Harrows for Mechanical Cultivation.** — MANRIN, G., in the *Journal d'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 3, pp. 50-51, 2 Figs. Paris, February 7, 1918.

Tractors can pass over ploughed land quite safely if they do not exceed a certain weight and if they are followed by a disc-harrow. The double disc-harrow gives excellent results; in the 1917 Noisy le-Grand (France) tests, with a double machine with 32 discs, working a width of 103 in. and a depth of about 3 to 4 in., M. RINGELMANN found that traction on already-hardened ploughed-land varied between 1034 and 1188 lb.; at 3 in. depth the work was well done, while at 4 in. the work was excellent.

The author describes. 1) a double disc-harrow, with 16 in. discs, built by T. PILTER of Paris; the machine is built in 2 models; one with 32 discs; weight, 1 078 lb.; width, 95 in.; the other with 40 discs; weight, 1 254 lb. and 118 in. wide.

2) a double disc harrow, made by the same maker, provided with toothed discs; the 32-disc model weighs 1 276 lb., and covers 95 in.; the 40-disc model weighs 1 342 lb. and covers 118 in. The discs of these 2 models are 18 in. wide.

The machines have steel frames; there are 4 levers, one per row of discs, so as to control the angle as well as the depth and character of the cultivation. In very hard soils, suitable weights can be placed on the frame to give greater grip.

562 — **Harrows with Rotary Spades.** — MANRIN G., in the *Journal d'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 5, pp. 92-93. Figs. 2. Paris, March 7, 1918.

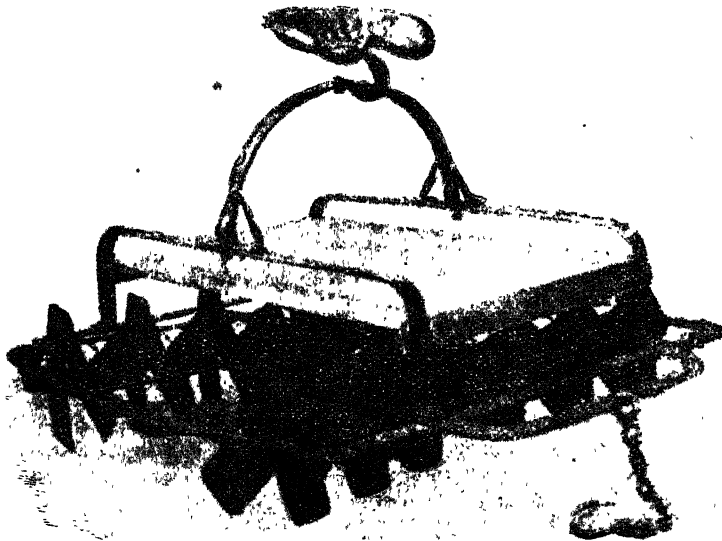
To break down the soil still further, harrows are used, whose toothed discs are replaced by members similar to stamped spades, called "herse à bèches roulantes, système WASSIS" in Switzerland, where they are much used.

As shown by the appended figure, the spade consists of a pressed steel plate fixed symmetrically on the axle; the successive spades are so mounted that their extremities follow 2 spirals. As with the discs of double disc-harrows, the spades are fixed on 4 shafts inclined towards the line of traction; the inclination of these shafts cannot be altered during the work; the shafts run on bearings fitted with STAUFFER lubricators using thick grease. The spades are scraped by iron rods fixed between 2 consecutive members. A platform is provided on the frame so that weights can be added if the driver's weight does not suffice.

For transport, the seat is removed, and the machine tipped over, when it slides on 2 flat runners.

In another model, the harrow is mounted on a tricycle. By means of a lever the spade-frame can be lifted on the 3 wheels for transport on the road.

These harrows are made by the Société FRITZ MARTI, of Berne, Switzerland. The small model has 28 spades mounted in groups of 7 on each



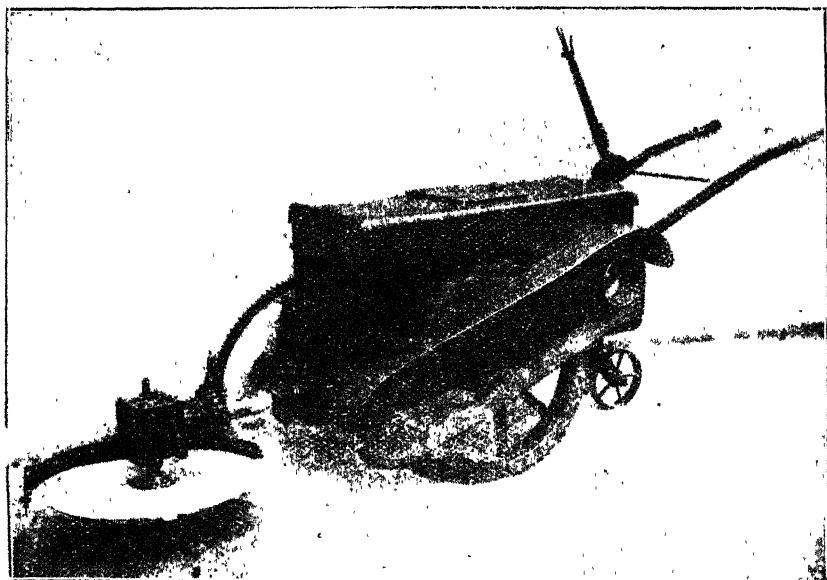
The WASSIS harrow with rotary spades.

shaft; it works a width of 43 in., and weighs about 400 lb. The large model weighs 462 lb., and has 36 spades mounted in groups of 9; it works a width of 55 in.

In medium soils, a team of 2 horses suffices to draw the small model, while the large one requires 4. The machine can produce a tilth some 3 or 4 in. deep under good conditions.

563 — The “Bucheronne”, a Machine for Felling and Sawing Coppice-Wood. — MATHIS DE GRANDSEILLE, in the supplement to the *Bulletin de la Société des Agriculteurs de France* (Comptes Rendus de l'Assemblée Générale de 1917, 48th Meeting), pp. 51-52. Paris, January, 1918.

M. MATHIS DE GRANDSEILLE, President of the 4th Section (Forestry) of the “Société des Agriculteurs de France”, reports the results obtained by M. PROCHE's machine — the “Bucheronne” — for felling and sawing timber (1), reproduced in the appended figure.



• The “Bucheronne”, for felling and sawing coppice-wood.

(1) On the request of M. MATHIS DE GRANDSEILLE, president of the Forestry Section of the “Société des Agriculteurs de France”, M. PROCHE, the inventor, has communicated the following additional information: —

The “Bucheronne” weighs about 550 lb. with its 3 H.P. electric motor; its speed can be varied and it has a special circular knife-blade whose rounded, bevelled knives are followed by a plane-tooth to clear the cut. The knife blade works in every direction and may be used quite close to the soil. To drive the machine, a 5 H.P. electrogenerating set is needed, furnishing a 220 volt current for the motor of the machine. The generator may be as much as 1600 ft. away.

The machine was tested in Crains forest, Yonne, France, in the presence of several officers of the Forest Inspection Department, the Central War Material Department of Angoulême, the Air Ministry, Woods and Forests, and Patents Office (Engineering section). According to their report, the soil should first be cleared of all shoots of less than 2 ½ in. in diameter. In woods over 30 years old, this is usually unnecessary; for good and continuous working there is needed: 1 driver for the machine, 1 sawyer for the knife-blade, 1 workman to guide the felled tree the right way, and 2 assistants to trim the felled trees and place them in heaps ready for sawing; total: — 5 men. For sawing, the same number of men is needed at the machine. The yield is very satisfactory, especially when compared with that of previous experiments. With the "Bucheronne" 5 men felled 120 trees of 2.7 in. diameter in 1 hour, and the crew of 5 men felled and sawed in 1 day, 741.63 cu. ft. of wood, while the same crew, working with axes, only felled and trimmed 1059.5 cu. ft. in 4 days. With the machine each workman will produce 141.26 cu. ft. per day, while without it he will only produce 35.31 cu. ft. If the coppice is older, the yield will be better. The machine, which is strongly built did very well throughout the trial. The inventor should improve the machine by furnishing greater grip on the soil and by providing a hood so that the knife blade can be inspected during working. It is hoped that the ASTER Co., which has the patent rights over the machine, will improve it.

564 — **The Austin Excavator for Drainage Ditching.** — See No. 506 of this *Review*.

565 — **The Use of Hydrogen for Driving Engines: Tests in Holland.** — Extract from the *Bulletin des Usines de Guerre*, in *Le Génie Civil*, Vol. LXXII, No. 13, p. 224. Paris, March 30, 1918.

Experiments carried out at the Hague with a motor car driven by hydrogen have shown that: —

- 1) a car engine will work quite regularly and perfectly on a mixture of pure hydrogen and air.
- 2) the engine does not require adaption.
- 3) the engine can work smoothly even with a very primitive type of carburettor.
- 4) the experiments that preceded the practical tests did not require a great outlay; a few tubes of hydrogen and the necessary mounting was all that was required.

These tests were carried out as a result of the shortage of petrol for public automobiles in Holland. A 1906 type "Spyker" 10-15 HP motor-taxi was used, which still ran well on petrol and which could still do over 30 miles an hour.

Below the body was placed a tube of hydrogen, 59 in long and provided with a manometer and a pressure-reducing valve. The hydrogen passed under 1 atmosphere pressure in a metallic tube leading to the carburettor. A tap, placed on the gas tube and connected to a pedal, controlled the supply of hydrogen. The air supply was not very well regulated, being done by hand, before starting.

After regulating the entry valves, in spite of the primitive form of the

carburettor, the engine worked quite smoothly and evenly without missing. The number of revolutions was found to be less with hydrogen than with petrol. By igniting at 8 mm. distance from the dead-centre, the maximum number of revolutions was obtained. No traces of naphthaline were found in the exhaust gas, which was found to be pure steam. The engine therefore worked perfectly on hydrogen and air, and that in spite of the casual methods used for adapting the carburettor.

The car started off on the first speed, changing to the second, and after running 15 minutes on the road, returned normally, the engine working perfectly all the time.

The tests and the trial run, which took 30 minutes in all, had required 1 ½ cu. metres of gas, while the pressure had fallen from 160 to 100 atmospheres.

### 566 - Review of Patents.

#### *Tillage Machines and Implements.*

Canada	180 157. Land levelling machine.
	180 607. Plough.
	180 629. Agricultural implement.
France	485 926. Rotary tilling perforator.
	486 009. Plough for mechanical traction.
Switzerland	77 326. Motor plough.
United Kingdom	110 892 — 112 230. Motorploughs.
	111 550. Motor driven land roller.
	111 917. Harrow.
	112 071. Plough.
	112 674. WYLES Balance motorplough.
	112 815. Balance plough to be hauled by cable
United States	1 251 498. Tractor plough.
	1 251 632. Drag attachment for ploughs
	1 251 636. Harrow attachment for ploughs.
	1 251 874. Disc scraper.
	1 251 945. Tilling machine.
	1 252 432. Agricultural implement.
	1 252 491. Plough attachment.
	1 252 574. Caster wheel for agricultural implements.
	1 252 658. Ridger.
	1 253 089. Plough depth regulator.
	1 253 175. Disc harrow.
	1 253 177. Plough share.
	1 253 307. Revolving harrow.
	1 253 609. Harrow.
	1 253 860. Disc garden plough.
	1 253 943. Attachment for sulky ploughs.

#### *Manures and Manure Distributors.*

Canada	180 470. Fertilizer distributor.
United Kingdom	111 552. Manure or like distributor.
United States	1 253 560. Process of extracting potash from felspar, etc

*Drills and Seeding Machines*

- United Kingdom 112 709. Planting tool.  
 United States 1 252 668. Plant setting machine.  
                   1 252 923. Check row planter.  
                   1 253 621. Seeder.  
                   1 253 694. Maize planter.  
                   1 254 266. Furrow opener for seeding machine  
                   1 254 555. Planter.

*Various Cultural Operations.*

- Canada 180 226. Weed destroyer.  
 United States 1 251 786. Tree protecting device.  
                   1 251 821. Cultivator attachment.  
                   1 252 128. Motor-cultivator.  
                   1 252 627. Garden tool.  
                   1 252 674. Cotton chopper tool lifting mechanism.  
                   1 252 749. Two row cultivator.  
                   1 252 914. Vine cutter.  
                   1 252 958 — 1 254 548. Cotton choppers.  
                   1 252 359 — 1 253 480 — 1 253 993. Maize cultivators.  
                   1 253 529. Attachment for Lister cultivators.  
                   1 251 600. Furrow filler and cultivator.

*Control of Diseases and Pests of Plants*

- Canada 180 648. Poison for rodents.  
 United Kingdom 111 536 — 111 873. Animal trap.  
                   111 876. Sprayer.  
 United States 1 252 510. Insecticide.  
                   1 252 756. Tree sprayer.  
                   1 253 672. Dusting and spraying apparatus.

*Reapers, Mowers and Harvesting Machines.*

- United Kingdom 112 198. Sickle.  
 United States 1 251 492 — 1 252 156. Horse hay rakes.  
                   1 251 939. Harvester reel support.  
                   1 252 016. Cotton picker.  
                   1 252 063 — 1 252 608. Harvesting machines.  
                   1 252 421. Lawn mower.  
                   1 252 631. Kafir-corn header.  
                   1 252 880. Double row corn cutter.  
                   1 253 153. Seed saving attachment for mowers.  
                   1 253 611. Maize husker.  
                   1 253 774. Cotton picker device.  
                   1 254 202. Stooking machine.  
                   1 254 379. Hay and grain sweep.

*Machines for Lifting Root Crops.*

- Netherlands 2 205. Machine for lifting plants without damaging the roots.  
 United States 1 251 575. Potato-digger.  
                   1 251 589. Beet topper, digger and loader.  
                   1 251 664 — 1 252 230 — 1 253 426. Beet harvesting machines.  
                   1 253 358 — 1 254 004. Beet toppers.

*Threshing and Winnowing Machines*

- Canada 180 613. Threshing machine.  
 United Kingdom 112 367. Flax threshing machine.  
 United States 1 251 520. Seed screening and selecting means for cotton gins.  
 1 252 398 — 1 253 167 — 1 254 422 — 1 254 506. Threshing machines.  
 1 253 312. Bean saving device for threshing machines.  
 1 253 601. Harvesting and threshing machine.

*Machines and Implements for the Preparation and Storage of Grain, Fodder, etc.*

- Netherlands 2 197. Fruit sorting machine.  
 Switzerland 77 328. Press for maize silage.  
 United States 1 251 510. Hay drying and the like.  
 1 251 573. Grain drier.  
 1 251 759. Hay stacker.  
 1 252 503 — 1 252 901. Hay loaders.  
 1 253 031 — 1 253 170. Shock loaders.  
 1 254 175. Feeder for pneumatic stackers.  
 1 254 203. Maize shock loading machines.

*Steering and Traction of Agricultural Machinery.*

- United Kingdom 111 392. Agricultural tractor.  
 112 382 — 112 579. Tractor couplings.  
 United States 1 251 553 — 1 251 613 — 1 254 446. Traction machines.  
 1 252 167. Tractor for ploughs.  
 1 252 356 — 1 253 643 — 1 253 319 — 1 253 833. Tractors.  
 1 253 073. Axle mount for tractors.  
 1 253 378. Flexible tractor tread.

*Feeding and Housing of Livestock.*

- Canada 180 448. Manger mechanism.  
 United Kingdom 111 777. Shoes for horses and mules.  
 United States 1 251 672. Hog feeder.  
 1 252 256. Hog oiler.

*Poultry Farming.*

- United Kingdom 112 048. Hatching and rearing appliance.  
 112 137. Automatic feeding appliance for poultry.  
 112 215. Method for preserving eggs.  
 United States 1 254 193. Combined poultry feeder and drinking fountain  
 1 254 273. Egg turning mechanism for incubators.

*Industries Depending on Plant Products.*

- Brazil 9 950. New process for extracting oil.  
 United Kingdom 110 945. Process of treating grain to modify the flavour.  
 111 523. Conveyer for bakery plant.  
 111 676. Process for extracting oil from the pericarp of palm nuts.  
 111 906 — 111 907. Process for purifying India rubber.  
 112 164. Artificial butter.  
 112 166. Process for purifying alcohols, etc.  
 112 232. Process for manufacturing alcohol.  
 112 286. Apparatus for depericarping palm fruit and for like purposes.

*Industries Depending on Animal Products.*

- United Kingdom 112 473. Treatment of meat intended to be preserved by chilling.



*Dairying.*

- Switzerland 77 366 — 77 367. Churns.  
 United Kingdom 111 527. Vessel for storing and heating milk.  
 112 034. Teat cup for milking machine.  
 112 060. Cow milker.  
 United States 1 251 465. Pasteurising apparatus.

*Farm Buildings and Equipment.*

- Canada 180 178. Door for silos.  
 180 199. Machine for making cement shingles.  
 180 409. Fence stay.  
 United Kingdom 112 040. Ground augers.  
 United States 1 251 704. Shingle.  
 1 252 477. Automatic litter carrier.

*Various.*

- United Kingdom 112 292. Centrifugal pump.  
 United States 1 251 552. Flower pot.  
 1 251 619. Wind mill.  
 1 252 160. Rotary pump.

## AGRICULTURAL INDUSTRIES.

567 — **The Passage of Wine over Fresh Lees.** — CARLES, P., in *Bulletin de l'Association des Chimistes de Sucrerie et de Distillerie*, Vol. XXXIV, Nos. 10-12, pp. 334-339. Paris, April-May-June, 1917.

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When new wine has been allowed to run freely much more wine than dry residue is left in the lees. The wine is retained in this sort of sponge by simple adhesion caused by the large surface, by capillarity, and, finally, because it is held in small cells (as water in starch jelly).

From 100 kg. of lees which have been drained only about 45 kg. of wine may be obtained by pressing. A certain part will, however, resist all pressure; this is the part in the finest capillary tubes, the smallest cells. To remove it the liquid must be mixed with another liquid, which will eject it by capillary force. It is on this principle that is based ROOS's diffusion method, which enables 70 % of wine, as pure as that originally drawn off, to be obtained from drained lees, whereas pressing only yields  $\frac{2}{3}$  of this amount.

If these 70 kg. are removed from the 100 kg. of drained lees, 30 kg. of solids are left in which are found closely mixed: — 1) bi-tartrate of potassium (cream of tartar); 2) tannin; 3) colouring substances; 4) pectic products; 5) substances imparting smell; 6) yeasts; 7) abundant ferric salts combined with 8) various mineral salts.

If, when a proportion of the wine represented by 100 kg. of lees has been drawn off, the new wine in the cask is replaced by an equal volume of old wine, and the contents again drawn off, the liquid obtained is equal in volume to the first, but its quality and composition vary according to the length of time it remained on the lees. If it has only passed over the lees without being left on them, the new element will be that part of the wine

which came in contact with each individual portion of the mass. It will be represented by the 45 kg. of new wine which pressing would easily have extracted, so that the second drawing off will be a mixture of the 45 kg. of new wine + the old wine; the last 45 kg. of old wine will have driven out the other and taken its place.

If contact with the lees is prolonged the influence of the new wine will be felt more because that contained in the capillary tubes will have had time to be replaced. The wine from the cask will contain all the new wine retained in the lees and old wine which for some time has been in contact with their reserve elements. As this reserve is large and usually greater than that which can be dissolved by a normal wine, all badly composed wine poured on this mass will tend to improve, by absorbing that in which it is lacking. Thus a sour wine which disease has rendered deficient in tartaric acid will take up this element in particular, a flat wine will take up flavour, a poor, exhausted wine will take up a provision of tartar.

If, for example, in a series of three casks, one, for some reason or other, has yielded a poor wine, it will be advisable to pass it over the lees of the two others successively, the weaker being used last.

In spite of all the care possible, wines sometimes have a bad flavour, detrimental to their use (flavour of mould, addled eggs, bitterness, fustiness, sourness, etc.). Such wines may often easily be improved merely by passing them over fresh lees, because they are aerated without exposure, and, moreover, in their immediate contact with the yeast they give up the flavours and smells of the disease.

So as to avoid after-taste all the head must be removed from the cask before the operation, because this is always more or less sour and contains the organism known as mother of vinegar.

When a defective wine is so treated, one of the defective elements remains in the lees, and the pressed wine and small wine finally obtained are of a quality inferior to that obtained by ordinary methods. Wines attacked by "casse" cannot benefit by the treatment described unless they have been previously completely cured of the disease.

**568 — The Alcoholic Fermentation of Banana Must** (1). — PERATTI, R., and RIVIERA, V., in *Le Stazioni sperimentali agrarie italiane*, Vol. I., Pt. 9-10, pp. 433-450, 1 Plate, with 9 Figs. Modena, 1917.

The various products of the *Musa sapientum* banana are first enumerated.

Little work has been done on the banana from a microbiological point of view. An important study by Mr. BAILEY (2) shows that the internal part of the pulp is sterile, but that bacteria are present in the internal part of the skin; during the normal ripening process these bacteria may find there favourable conditions of development. Messrs. ROTHENBACH and EBER-

(1) See also *B. Nov.*, 1914, No. 1054. (Ed.)

(2) BAILEY, E. M., Biochemical and Bacteriological Studies on the Banana, *Jour. Amer. Chem. Soc.*, Vol. 34, No. 12, pp. 1700-1730, 1912; *Jour. Biol. Chem.*, Vol. II, No. 2, 1912. (Author).

LEIN (1) show that the formation of the ethers of the banana (isovalerianic isoamylic ether and ethylic ether) does not depend on bacterial action. As regards the utilisation of the banana for fermentation, there is only the paper of M. D'HERELLE (2), who discusses the possibility of using the residue from the preparation of dried bananas and their flour for making fermented drinks. The authors, therefore, considered that a bacteriological study of the banana and the fermentations to which it may be subjected, would be of interest.

The fermented liquid obtained with a must of skinned bananas distinctly showed the characters of alcoholic liquids, but had lost the delicate flavour of the fruit. As this was attributable to the absence of the banana skin the experiment was recommenced, leaving the pulp in the skin.

The must was prepared as follows: the whole fruit was cut into thin slices and passed through a press; the liquid obtained was filtered through linen and diluted with water in the ratio of 1 : 2.5 parts. The residue was digested for 10 hours at 80°C. in  $2\frac{1}{2}$  times its weight of water, and the filtered liquid mixed with the first, so that the final liquid was diluted to  $\frac{1}{5}$ . This must, of a fine dark yellow, was filtered through paper and kept in sterilised flasks.

Part of the must was used for the preparation of a special nutritive gelatine, by the addition of 10 % of commercial gelatine, and for the preparation of a special agar, by the addition of 1.5 % of agar. Another part, removed before sterilisation, was fermented at 28° C. The fermentation started rapidly and was strong; acidification started after 48 hours.

The following bacteria were isolated and grown on the banana gelatine and agar: —

1) a *Saccharomyces*, predominant in the liquid, which the authors called *Sacch. Musae*; 2) a bacterial form, abundant in the liquid (*Bacillus* sp. ?); 3) a variety of *Oospora lactis*; 4) a variety of *Mycoderma*.

The authors describe the first three microorganisms and give in details the results of the study of their nutrition, their growth in various culture media, and their action when isolated, combined in groups of two, or all three together. From this last point of view it was noticed that the action of the *Saccharomyces* is inhibited by the presence of the bacterium, and also, though much less, by the presence of the *Oospora*. The following results were obtained with the banana must: —

Microorganism	Specific gravity at 15° C.	Alcohol per 100 in volume
<i>Saccharomyces Musae</i> . . . . .	0.9978	1.48
<i>Bacillus</i> sp. . . . .	1.0000	—
<i>Oospora lactis</i> var. . . . .	1.0000	—
<i>Sacch.</i> + <i>Bacillus</i> . . . . .	0.9992	0.53
<i>Sacch.</i> + <i>Oospora</i> . . . . .	0.9980	1.34
<i>Oospora</i> + <i>Bacillus</i> . . . . .	1.0000	—
<i>Sacch.</i> + <i>Oospora</i> + <i>Bacillus</i> . . . . .	0.9990	0.67

(1) ROTHIMBERG, F. and EBERLEIN, I., The Occurrence of Esters in Bananas, ref. in *Exp. Stat. Recd.*, Vol. XVII; *Deut. Essigindustrie*, No. 9, pp. 81-82, 1905. (Author).

(2) D'HERELLE, F. H., Utilization of the Surplus Banana Crop, *Bull. Offic. Soc. Agr.*, Vol. 3, No. 3, pp. 241-243, Cuba, 1907. (Author).

In view of the unfavourable influence of the bacillus and *Oospora* the experiments were henceforth only carried out with *Sacch. Musae*. Banana must was prepared with 5.5 lbs. of finely cut fruit and skin digested with twice their weight of water at 55° C, for 2 hours on 3 consecutive days. The liquid was sown with the *Saccharomyces*, after a sample had been taken for an analysis which gave the following results : —

polarisation	before inversion	2.40 %
»	after	2.30 »
Fehling	before	6 »
»	after	61 »

thus showing the absence of saccharose and the presence of glucose and invert sugar, which, calculated as invert sugar, are present in the proportion of 68.66 ‰.

Fermentation was set up in 4 litres of must in a large glass bottle. The determination of the alcohol, made when the strong fermentation had ceased (after 10 days), gave a specific gravity at 15° C. of 0.9979 and 1.41 % of alcohol in volume;  $\frac{1}{8}$  of the sugar had, thus, already changed to alcohol.

Part of the fermented liquid was rapidly filtered through cottonwool, without pressing the solid portion, and the filtrate poured into a bottle which was hermetically closed.

The bottle was opened after about two years, and the contents found to have kept well. The liquid had the pleasant smell of the fruit, was very clear and straw coloured. The taste, however, did not fulfill the promise of the smell. This was due to the dilution of the must, which made the wine rather flavourless and its alcohol content low, while the amount of sugar present was insufficient to compensate for these faults. It is, however, impossible to avoid such a dilution because of the excessive thickness of the undiluted must and its high content in mucilaginous substances. It is practically impossible to prepare an alcoholic drink by the fermentation of natural banana must; it is necessary to add sugar, and, perhaps, to purify the must when the strong fermentation phase is passed. Under these conditions it is possible to obtain successfully from the banana a fermented liquid of good colour, slightly alcoholic and of attractive qualities, amongst which the agreeable smell of the fruit holds first place. The authors intend to carry out further experiments on the subject.

569 — **The Production of Alcohol from Algae.** — KAYSER, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 14, pp. 450-451. Paris, April 17, 1918.

For some time marine algae have been used as a food for man on account of their richness in carbohydrates. Quite recently they have also been used as a substitute for oats in the feeding of horses (1). In bacteriology agar-agar (gelatine) is used as a basis for nutritive media. In this case the gelatine media and the acid solutions must be sterilised separately and mixed after sterilisation so as to prevent the gelatine from changing into sugar.

The author (Lecturer at the National Agricultural Institute) has made

(1) See R. March, 1918, No. 320. (*Ed.*)

an investigation into the amount of fermenting sugars which might be obtained under pressure and by the action of acids.

At the Pasteur Institute the water content of *Laminaria digitata*, previously washed to extract the mineral salts, or unwashed, was reduced by evaporation to 10 %. The algae were then treated with water containing 3, 4, and even 6 % of sulphuric acid for half an hour or an hour at 122° C. The sugary liquid was neutralised to 1 % of acidity, nitrogenous material added in some cases, and sprinkled with brewers' yeast. Fermentation occurred without difficulty, but somewhat better in the flasks containing nitrogenous matter. An average of 6 litres of alcohol per 100 lb. of dry algae was obtained.

It is probable that larger quantities could be obtained commercially, when higher pressure is possible. The author is of opinion that the solid liquid residue could subsequently be used for the extraction of mineral matter and potash, thus serving a double purpose.

570 — **Sorghum or Dari, a New Substitute for Malt Used in Brewing.** — RAUX, J., in *Brasserie et Malterie*, Year VII, No. 24, pp. 372-375. Lyons, March 5, 1918.

For several months brewers have been offered as a new substitute for malt, sorghum or dari, also called "dura" and "Guinea millet". Owing to the high price of rice and maize, used as substitutes in brewing, and their present use, particularly for bread-making, it was suggested that sorghum, which is cheaper, might be used in their stead. It is offered either as a meal or as whole grains; sometimes the grain is not decorticated and the yield in extract is then low (about 10 %).

The moisture content is from 12 to 15 %. If too damp the sorghum quickly goes bad turning sour and takes on an abnormal odour.

The yield in extract — 64 to 70 % — is much below that given by maize, and especially by rice. In maize it depends on the extent of cleaning. Sorghum is delivered at the brewery without any special treatment, but it would be easy to treat it in such a way as to remove part of the fats, which amount to 3 to 5 %, *i. e.*, little less than those contained in crude maize. In sorghum, as in maize these substances hinder the solution of the starch, thus accounting for a yield in extract below that which might be expected from the proportion of starch it contains (62 to 66 %).

Sorghum fat also has the disadvantage of going rancid fairly quickly. Care must, therefore, be taken to store the grain in good condition and to use nothing with any rancid smell, as this might be transmitted to the beer.

Most of the samples contain a fairly large amount of total protein; this would account for the rapid spoiling of over-damp grain. Most of this protein, however, is insoluble and, as in all crude grain, does not pass into the must and can have no influence on the keeping quality of the beer.

Sorghum is used in the same way as maize and rice, *i. e.*, it is added during the first mashing or to the copper. It may be advantageously used in brewing. The only difficulty is that of filtering, which is attributed to the use of excessively fine meal, which must not exceed a certain degree of fineness. From the point of view of filtering, treatment during boiling is advantageous as it allows all the starch to be dissolved by dividing the cellulose of the grain into the smallest possible particles.

571 - **Microscopical Studies on Tomato Products** (1). — HOWARD, BURTON J., in collaboration with STEPHENSON, CHARLES H., in *United States Department of Agriculture Bulletin* No. 581, pp. 24, 5 Fig., 12 Tables. Washington, October 6, 1917

During the past few years the Bureau of Chemistry has conducted a very comprehensive investigation to establish a basis for judging tomato products. Experiments were conducted in the bureau laboratory and also in factories, a large number of which were visited. Out of the mass of data thus collected, it was felt that the scientific facts underlying the relationship between microorganisms and the rot and decay of tomato products should be of value to manufacturers and food control officials at the present time. The results bearing upon the relation of the physical condition of the stock from which tomato products are made to the number of microorganisms present in tomato products are therefore given in this bulletin.

A great many tests at factories were made by noting the general condition of the stock and then examining microscopically samples of the finished products. The criteria published in 1911 in the Bureau of Chemistry Circular 68, for the guidance of manufacturers, were reached largely by such experiments.

Tomato products promptly made from stock judged acceptable by visual inspection never showed high counts of microorganisms. Similarly, products made from stock obviously not good or from stock improperly handled usually showed high counts. It may therefore be assumed that high counts of organisms in such products indicate unmistakably that the stock used was in bad condition or was handled in an insanitary manner during manufacture.

It was found that tomato pulp stored in barrels usually gave high microscopical counts; hence it would seem inadvisable to use barrels for storing the product.

Field work performed during the past three seasons has proved that with proper equipment and factory management there is no reason for stock ready for the cyclone to contain over 1 per cent of decayed material.

In factories where the stock is properly handled the mould count is of greater importance than the counts of the other organisms in judging the condition of the raw stock. High counts of yeasts and spores, and bacteria are more frequently an indication of secondary than of primary spoilage. A low mould, yeast and spore or bacterial count does not necessarily indicate sound stock, but a high count in any of these organisms always indicates bad stock or improper handling.

It was found that, of the samples made in the laboratory, none with less than 5.5 per cent of rot gave a mould count of more than 50 per cent of microscopical fields. In the case of the factory samples the mould count rose sharply from 0 to  $\frac{1}{2}$  per cent of rot. Beyond  $\frac{1}{2}$  per cent the rate of rise gradually decreases, until after 20 per cent of rot the rate of increase is slow. A mould count of 40 may be obtained in samples having any amount of rot between 2.2 and 100 per cent.

(1) See also R., September 1917, No. 856. (Fdl)

A yeast and spore count of 20 per  $\frac{1}{80}$  cm. represents about 1 per cent of decay. From this point the rate of increase is slow.

A bacterial count below 15 000 000 per cc. indicates little as to the amount of decay. Beyond this point, however, up to 20 per cent of rot the rate of increase is about 20 000 000 for each per cent. of rot.

An investigation of the manufacture of tomato sauces and pastes in Italy showed that Italian products should be equal to American products made under similar conditions. The mould count for the concentrated products was found to be about the same as that for pulp, and the yeast spore and bacterial counts to be proportional to the degree of concentration. Sauces and pastes made from objectionable material run particularly high in yeasts, spores and bacteria. High counts on this class of products, then, indicate bad stock or insanitary handling.

572 - **The Importance of Bacterial Action in Indigo Manufacture.** — HUTCHINSON, C. M. (Imperial Agricultural Bacteriologist, Pusa), pp. 11. Calcutta 1917.

As the result of investigations carried out in the Imperial Laboratory during 1916 in conjunction with the Indigo Research Chemist, it has become apparent that the yield of indigo from a given weight of indigo plant depends upon the intervention of bacteria during the steeping process. The account of the work done on this subject is intended to give some idea of the manner in which this fact has been ascertained, the extent to which it is probable that bacterial action affects yield, and the possible ways of making use of this new piece of information so as to successfully modify existing factory practice. It is remarkable that so far as published records are concerned, no previous work on these lines has apparently been done in India, as the obviously bacterial nature of the fermentation process going on in the steeping vat would naturally suggest investigation into the action of such bacteria upon the plant and upon the important part of it which goes into solution in the water.

The chief conclusions reached in the present study are as follows:—

- 1) The yield of indigo depends largely upon bacterial action.
- 2) Some kinds of bacteria operate beneficially, others detrimentally. In the absence of the former class in sufficient numbers there will be a reduction in yield.
- 3) It should be possible to ensure the presence of the beneficial kinds by artificial inoculation.
- 4) It is necessary to bring the bacteria normally present on the walls of the steeping vat into closer contact with the indigo plant in the vat, by altering the shape of the latter so as to reduce the ratio of cubic content to wall area.
- 5) It will probably be found beneficial to modify the character of the wall surface so as to promote more extensive and permanent growth of the beneficial bacteria.

573 - **The Use of *Imperata cylindrica* in Paper Making; Experiments in Italy.** — VIGNOLO-LUTATI, FERDINANDO, in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LVIII, 1915, pp. 68-76. Turin, 1916.

Since 1913 (*L'Industria chimica*, Nos. 2 and 13, Turin, 1913), the author, attached to the Chemical Laboratory of Commercial Products at the

Royal Institute of Commerce of Turin, has carried out laboratory experiments and industrial investigations into the utilisation of *Imperata cylindrica* as raw material in paper-making. In his laboratory experiments he treated the leaves by the soda method; in the industrial experiments the calcium bisulphite method was used. The results obtained in the laboratory experiments led to the conclusion that:— 1) under normal pressure the cellulose (which is easily bleached by the ordinary methods) may be extracted from *I. cylindrica* without difficulty in quantities amounting to 40 % of air-dried raw material; 2) the fibre of *Imperata*, *Stipa* and *Lygeum* are very similar. From the results obtained in the industrial investigations it may be concluded that:— 1) the cellulose of *I. cylindrica* is very similar to that of esparto grass; 2) the yield of bleached cellulose may amount to 38 %; 3) no greater consumption of chemicals is required to reduce to paper pulp the cellulose of *Imperata* than to reduce that of esparto.

In the industrial experiments the soda method was tested with the following results:—

The best conditions for obtaining an easily bleached pulp are realised by using the autoclave under a pressure of from 2 to 3 atmospheres and caustic soda in quantities not less than 10 % of the air-dried raw material. An excess of soda facilitates bleaching but reduces the pulp yield. The yield is higher with low pressure (1 to 2 atmospheres) and prolonged boiling than with greater pressure and shorter boiling. The crude fibre obtained with 10 to 15 % caustic soda contains a high proportion of slimy substances which are largely removed by prolonged washing. By the use of 10.6 % of soda and 6 hours' boiling under a pressure of 3 atmospheres, 37 % of crude fibre is obtained. If this is treated with 15 % calcium chloride (containing 33 % free chlorine), a satisfactory white fibre is obtained. If a larger quantity (15.9 %) of caustic soda is used under the same conditions of boiling and pressure, the yield is slightly less, and, when treated with 12.4 % of calcium chloride, a perfectly white fibre is obtained. The yield of bleached fibre is thereby raised to about 35 %, but if normal pressure is used the yield is from 39 to 40 %.

The stems (70-80 cm. long, 3-4 mm. in diameter at the lower internodes and about 2 mm. at the upper internodes; water content about 11 % when air-dried), stripped of their nodes, chopped and crushed, then treated by the methods used for the leaves, give about 45 % of bleached cellulose.

According to HACHEL there are 3 varieties of *I. cylindrica*:—

- 1) a) var. *genuina* sub-var. *europaea*, growing on the sandy shores of rivers and the sea throughout the Mediterranean district, and even as far as the Sahara and Caspian Sea;
- b) var. *genuina* sub-var. *Thunbergii*, of central and southern Africa;
- 2) var. *condensata*, of Chili;
- 3) var. *Koenigii*, of East Africa and southern and eastern Asia.

In his experiments the author used *I. cylindrica* var. *genuina* sub-var. *europaea*. In certain districts varieties of *Imperata* have been of great service in fixing moving sands and in fighting the desert. For this reason when these plants are to be used in such districts for paper-pulp they should be cut and not uprooted, so as not to injure growth.



In Italy *I. cylindrica* grows mostly on the southern Tyrrhenian coast, on the Ionian coast, and in the islands. In Calabria it is often found as a weed, infesting the olive-orchards in particular. In this last case harvesting and using it would not only improve olive growing, but would also form a source of income.

574 - Dairy Inspection in the United States. — BAILEY W. H., in the *Journal of the American Veterinary Medical Association*, [Vol. LII, No. 6, pp. 686-692. Ithaca, N. Y., February, 1918.

In this address delivered at the 54th Annual Meeting of the American Veterinary Medical Association, the following points were discussed: 1) Healthy Cattle; 2) The Importance of Clean Milking Methods, Cooling, Transportation and Distribution Methods; 3) Pasteurization.

The following points were emphasized concerning the value of close correlation of dairy and milk inspection: —

a) Milk produced under filthy conditions may possess a low bacterial count if it is instantly and constantly cooled to 50° F. or below.

b) Milk produced under sanitary conditions may possess a high bacterial count at the time of distribution, if it has not been cooled and maintained at proper temperature.

c) A high scoring dairy may, at times, produce a badly contaminated milk, while a dairy scoring very low may produce clean milk.

d) Thus careful inspection of gross conditions and the rating of their value in terms of per cent. on the government score card, together with milk inspection, particularly bacterial analysis, will enable any health department to judge its milk supply correctly.

The establishment of a government milk hygiene service for the control and regulation of milk production throughout the United States is advocated.

575 - The Daily per Capita Consumption of Milk in the United States (Connecticut). — JUDKINS, H. F., *Journal of Dairy Science*, Vol. I, No. 3, pp. 246-249. Baltimore, September, 1917.

While it is difficult to compile any accurate figures on the daily per capita consumption of milk, it is generally conceded that the average for the United States is about 0.6 of a pint. This is a little more than a glass a day. That this is too small an amount is beyond question considering that from the standpoint of protein, which is especially needed by the growing child, or from the standpoint of total energy as utilized by the adult, much more food value is obtainable from milk for a given sum of money than can be purchased in any comparable food.

The following table recently prepared by the United States Department of Agriculture illustrates this point: —

Protein.	Energy.
1 quart of milk is equal to:	1 quart of milk is equal to:
7 ounces of sirloin steak	11 ounces of sirloin steak
6 ounces of round steak	12 ounces of round steak
4.3 eggs	8 ½ eggs
8.5 ounces of fowl	10.7 ounces of fowl.

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Were it not for the infant the per capita consumption would be much less than it is. According to Vermont Bulletin 195 one sixth of the milk produced by 22 000 000 cows is used as a food for infants and young children. It has been figured that an infant consumes 530 quarts of milk during the first year of its life.

In order to study the per capita consumption of milk first hand data were tabulated from families living in Storrs to whom the Connecticut Agricultural College retails daily about 90 quarts and hence accurate records were available.

The families were divided into three groups : —

#### GROUP I.

*Families with one or more children under three years.*

	Number of days	Number of pints	Average daily consumption	Number in family	Average per capita (pints)
Total . . . . .	1 019	5 679	55.46	39	—
Average . . . . .	101.9	567.9	5.546	3.9	1.42

#### GROUP II.

*Families with children three to twelve years.*

Total . . . . .	586	1 780	18.02	24	—
Average . . . . .	97.6	296.6	3.003	4	0.75

#### GROUP III.

*Families with no children.*

Total . . . . .	873	1 517	19.72	2.3	—
Average . . . . .	76.09	135.1	1.79	2.0	0.895
Average per 27 families . . . . .	—	—	3.45	3.22	1.07

The per capita consumption of milk on 17 farms where it was produced resulted in 1.30 pints daily with considerable variation in different families.

576 - **Chemical Changes in the Souring of Milk.** — VAN SLYKE, LUCIUS L. and BOSWORTH, ALFRED W. (Chemical Laboratory of the New York Agricultural Experiment Station, Geneva), in *The Journal of Biological Chemistry*, Vol. XXIV, No. 3. pp. 191-202. Baltimore, Md., 1916.

Fresh milk was analyzed for its soluble and insoluble constituents, a porous porcelain filter being used to make separation. Another portion of the same milk was inoculated with a culture containing *Bacterium lactis acidii* and *Bacterium lactis aerogenes*. At the end of 60 hours determinations were made of the soluble and insoluble portions. About 22 per cent of the milk-sugar was changed by the lactic acid bacteria, 88.5 per cent of the amount changed being converted into lactic acid. Citric acid completely disappeared.

The insoluble inorganic constituents of the fresh milk were made soluble by the lactic acid. Albumin of sour milk passed through the

porcelain filter completely. Calcium caseinate was changed into free protein and precipitated, the calcium forming lactate.

To study the rate and extent of chemical change under given conditions, fresh, pasteurized, separated skim-milk was inoculated with a pure culture of *Bacterium lactis acidii* and kept at 32.2° C. Samples were taken for analysis at intervals during 96 hours. Most of the change in milk-sugar occurred between the 10th and 24th hours. When the milk contained 0.7 per cent of lactic acid, the bacterial activity was much reduced. The acidity increased most rapidly during the first 24 hours, the rate of increase diminishing after that. The increased acidity of the serum was due to increase of lactic acid. In the insoluble portion of the milk the free casein is the acid constituent. Calcium combined as  $\text{CaHPO}_4$  goes into solution completely in 13  $\frac{1}{2}$  hours. Calcium combined as caseinate was acted upon more slowly, complete solution requiring about 24 hours. The amount of albumin nitrogen in the serum increased with increase of acidity; all the albumin of the milk appears in the serum in 14 hours.

577 - Studies on Goat's Milk. — I. The Casein of Goat's Milk: II. The Soluble and Insoluble Compounds of Goat's Milk. — BOSWORTH, ALFRED W. and VAN SLYKE, LUCIUS L., in *The Journal of Biological Chemistry*, Vol. XX, 3, pp. 173-175; 177-185. Baltimore, Md., 1916.

I. — On the basis of the analytical results obtained in the study of the compounds formed by casein of goat's milk with bases, taken together with the amount of phosphorus and sulphur found in such casein, the molecular weight is 8 888 and the valency of the protein molecule in basic caseinates is 8.

II. — Goat's milk contains two general classes of compounds, those in true solution and those in suspension or colloidal solution. These two portions can be separated for study by filtering milk through a porous earthenware filter like the PASTEUR-CHAMBERLAND filtering tube.

Serum prepared from fresh milk of goats is nearly transparent, with a faint greenish-yellow tinge and slight opalescence. The following constituents are in true solution: sugar, potassium, sodium, chlorine. The following are partly in solution and partly in suspension or colloidal solution: albumin, inorganic phosphates, calcium, magnesium, citrates. The following are entirely in suspension or colloidal solution: fat, casein.

The insoluble portion of milk, freshly prepared and moist, is grayish to greenish-white in colour, of a glistening appearance, and of gelatinous consistency. When shaken with water, it goes into suspension, forming a mixture having the opaque, white appearance of milk. Such a suspension is neutral to phenolphthalein. When purified, the insoluble portion consists of neutral calcium caseinate ( $\text{Casein Ca}_4$ ), di- and tri-calcium and magnesium phosphates.

The insoluble portion, suspended in water and treated with neutral potassium oxalate, reacts alkaline to phenolphthalein, indicating the presence of tri-calcium phosphate. This is shown also by a quantitative comparison of the amount of bases and acids.

The acidity of the serum is considerably greater than that shown by the milk after treatment with neutral calcium oxalate. This is accounted for by the presence of di-calcium phosphate.

The following arrangement is tentatively suggested as representing the forms in which the constituents of goat's milk may be present : —

	per cent
Fat . . . . .	3.80
Proteins, combined with calcium . . . . .	3.10
Milk sugar . . . . .	4.50
Salts : . . . . .	0.94
Di-calcium phosphate . . . . .	0.092 per cent.
Tri-calcium phosphate . . . . .	0.062
Di-magnesium phosphate . . . . .	0.068
Tri-magnesium phosphate . . . . .	0.024
Mono-potassium phosphate . . . . .	0.073
Potassium citrate . . . . .	0.250
Potassium chloride . . . . .	0.160
Calcium chloride . . . . .	0.115
Sodium chloride . . . . .	0.095
Total solids . . . . .	12.34

#### 578 — A Comparison of the Composition of Cow's Milk, Goat's Milk, and Human Milk.

— BOSWORTH, ALFRED W. and VAN SLYKE, LUCIUS I. (Chemical Laboratory of the New York State Agricultural Experiment Station, Geneva), in *The Journal of Biological Chemistry*, Vol. XXIV, No. 3, pp. 187-189. Baltimore, Md., 1916.

The authors have published statements attempting to indicate the individual forms or compounds in which the salts exist in cow's milk (1), goat's milk (2) and human milk (3). It is a matter of interest to bring these results together in order to see in what respects the three kinds of milk differ. In the appended table the figures which have a special interest are those relating to the salts, and we notice the following points in relation to these compounds.

**PHOSPHATES.** *Cow's Milk.* — The insoluble phosphate is di-calcium phosphate; tri-calcium, di- and tri-magnesium phosphates do not appear to be present. The soluble phosphates are mono-magnesium and di-potassium which constitute about two-thirds of the total phosphates.

*Goat's Milk.* — This differs from cow's milk 1) in containing tri-calcium, di- and tri-magnesium and mono-potassium phosphates, and 2) in containing no mono-magnesium or di-potassium phosphates.

*Human milk.* — This differs noticeably from both cow's milk and goat's milk in containing no insoluble phosphates, but only the soluble compounds; mono-magnesium and mono-potassium phosphates. The phosphates in human milk are much less in amount than in cow's or goat's milk.

**CITRATES.** All three milks contain potassium citrate, while cow's milk and human milk contain sodium citrate also.

**CHLORIDES.** Chlorides are present in goat's milk in much larger amounts

(1) See B. May 1915, No. 548. (2) See No. 577 of this Review. — (3) See: *The Journal of Biological Chemistry*, Vol. XX, pp. 707-709, 1915. (Ed.)

than in cow's milk or human milk; the amount in cow's milk is considerably larger than in human milk. In cow's milk and human milk the chloride appears to be calcium chloride, while in goat's milk potassium and sodium chloride are also present.

**TOTAL SALTS.** The total amount of salts in human milk is about one-third that of cow's milk or goat's milk. The number of different salts appears to be greatest in goat's milk and least in human milk.

*Compounds in Cow's Milk, Goat's Milk, and Human Milk.*

Compounds	Cow's Milk per cent	Goat's Milk per cent	Human Milk per cent
Fat. . . . .	3.90	3.80	3.30
Milk-sugar . . . . .	4.90	4.50	6.50
Proteins, combined with calcium . . . . .	3.20	3.10	1.50
Salts: . . . . .	0.901	0.939	0.313
Di-calcium phosphate . . . . .	0.175	0.092	0.000
Tri-calcium " . . . . .	0.000	0.062	0.000
Mono-magnesium " . . . . .	0.103	0.000	0.027
Di-magnesium " . . . . .	0.000	0.068	0.000
Tri-magnesium " . . . . .	0.000	0.024	0.000
Mono-potassium " . . . . .	0.000	0.073	0.069
Di-potassium " . . . . .	0.230	0.000	0.000
Potassium citrate . . . . .	0.052	0.250	0.103
Sodium " . . . . .	0.222	0.000	0.055
Potassium chloride . . . . .	0.000	0.160	0.000
Sodium " . . . . .	0.000	0.095	0.000
Calcium " . . . . .	0.119	0.115	0.059

579 - **Pasteurization of Cream.** — LARSEN, C., FULLER, J. M., JONES, V. R., GREGORY, H. and TOLSTRUP, M., in *Agricultural Experiment Station, South Dakota State College of Agriculture and Mechanic Arts, Dairy Husbandry Department, Bulletin No. 171*, pp. 529-548 9 Tables. Huron, S. D., November, 1916.

Some European countries have required for some time that all butter be made from pasteurized cream. In the United States about  $\frac{2}{3}$  of the butter is now made from pasteurized cream, and pasteurization of cream for butter making is constantly increasing.

The chief purposes of the writers' experiments were:— 1) to ascertain the efficiency of the coil cream vat for pasteurization of cream; 2) to determine the effect of different temperatures of cream pasteurization upon: a) germ content of cream; b) chemical composition of cream; c) size and condition of butterfat globules in cream; d) keeping qualities and acidity of butter manufactured.

The equipment consisted in a 150 gallon coil cream vat, a 20 HP return tubular boiler and a 15 HP engine which ran the coil in the cream vat. The cream was of uniform good quality and contained 30 per cent butterfat. When the steam pressure reached 73 lb., the coil in the vat was started and run 10 minutes at the speed of 42 to 45 revolutions per minute. After thus mixing the cream, samples were taken for chemical and bacterio-

logical analysis and for measurement of fat globules. The temperatures of pasteurization were as follows: — in one series of experiments the cream was heated to 140° F for 25 minutes; in a second series to 160° F for 10 minutes; in a third series it was heated to 180° F and cooled immediately. Subsequently the cream was cooled to ripening temperature, or about 75° F; after cooling samples were again taken for chemical and bacteriological analysis and for measurement of fat globules; 8 to 12 % of starter was added, and each lot of cream ripened as nearly as possible to the same acidity. The percentage of acid developed in the cream varied from 0.45 to 0.55. After ripening, which required from 2 to 6 hours, the cream was cooled to a few degrees below churning temperature (52° to 56° F.), held from 1 to 2 hours and then churned. A sample of butter from each churning was placed in cold storage (at about 40° F); the acidity and score of the butter was determined when the butter was fresh and at the end of 1, 2 and 3 months.

The results may be summarized as follows: —

It was found that in pasteurization of cream at different temperatures namely, 140° F. for 25 minutes, 160° F. for 10 minutes and 180° F., with immediate cooling, the temperature of 160° F. for 10 minutes was the most effective in destroying total micro-organisms. Pasteurization of cream at 160° or 180° F. proved more efficient in killing moulds and non-acid forming organisms than pasteurization at 140° F.

The only noticeable change in composition of cream due to pasteurization was a slight decrease in percentage of water, and a consequent increase in percentage of total solids.

There was a slight decrease in acidity of the cream after pasteurization at temperatures of 140° and 160° F. Cream pasteurized at 180° F. showed on the average less decrease in percentage of acid. This is probably due to the fact that the decrease in acidity by volatilization of acids just about offsets the increase in acidity through evaporation of water from the cream.

Numerous microscopical examinations of fat globules in raw and pasteurized cream show that at the higher temperature (160° and 180° F.) the fat globules tend to coalesce or unite. This is probably due to the higher heat, together with the greater agitation of the cream by the coil.

In no instance was it noticed that the high pasteurization temperatures unfavourably affected the body of the butter.

Butter made from cream pasteurized at 180° F. retained its keeping qualities the best.

The different temperatures of pasteurization did not have any important effect on the chemical composition of the butter.

580 - **Concerning Rancidity of Butter.** — GUTHRIE, E. S. (Department of Dairy Industry, Cornell University), in *Journal of Dairy Science*, Vol. I, No. 3, pp. 218-233. Baltimore, September, 1917.

The plan of research of the investigations, concerning rancidity of butter, reported in this paper, was outlined as follows: — Is rancidity due to chemical, cow enzymic, or biological changes? On account of lack of time to study all the factors, the first two changes were the only ones investigated.

So long as most of the previous investigators thought that oxidation

was the main consideration in the development of rancidity, the chemical changes were studied with special reference to the iodine number.

The chemical changes in butter were found to be very slight when biological agencies were held in check. These changes did not cause rancidity. The enzymic development caused very little variation in the iodine number, and it produced no rancidity.

The exposure of butter and butter fat to high temperatures, light and air, did not cause a marked change in the iodine number, and this exposure did not cause rancidity. Rancidity of butter as defined by butter dealers and expert butter judges is rarely found. The average persons thinks of the strong flavour of butter as rancid.

A bibliography on the subject is appended.

581 - **Indole and Scatole in Cheese.** — NELSON, V. E. (Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry* Vol. XXIV, No. 4, pp. 533-536. Baltimore, Md. 1916.

In attempting to isolate certain amines and other decomposition products resulting from the action of various microorganisms upon amino-acids found in cheese, the author observed that Limburger and "Handkäse" contain a considerable amount of indole and that the former also contains an appreciable quantity of phenolic bodies. This led to a study of other varieties of both soft and hard cheese, to determine whether they contained such substances as indole, scatole and phenol.

The method of procedure was to macerate about 400 gm. of cheese with water, place the mixture in a 5 litre flask, and distil with steam. To the distillate were applied tests for the detection of indole, scatole, phenol and ammonia. The results were as follows: —

Indole and phenol were found to be present in Limburger cheese. Scatole was not found in Limburger cheese. Indole is present in *Handkäse*. It is doubtful if scatole and phenol are to be found in this type of cheese. A trace of indole is present in Camembert cheese. Scatole and phenol are absent in this type of cheese. Cheddar, Swiss, *Gammalost*, brick, and Roquefort do not contain any indole, scatole, or phenolic bodies.

The amount of indole in a Limburger cheese naturally varies, depending upon how far the ripening process has gone. A young cheese may contain such a small amount that a quantitative estimation is impossible, while a good ripe Limburger cheese may contain as much as one part in 52 800 parts of cheese.

Lactic and bulgaricus forms of organisms when grown upon media containing tryptophane produced no indole or scatole. As growing organisms upon pure amino-acids is more difficult than upon proteins it may be necessary to add a little peptone or milk to the culture and until further work has done upon this phase it will be impossible to say that these organisms do not produce these putrefactive substances.

The liquefying coccus isolated from a Cheddar cheese appears to produce traces of indole from tryptophane.

582 - Cheese Mites. — EALES, NELLIE B., in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 10, pp. 1087-1096. London, January, 1918.

The experiments described were carried out at the Zoology Department of University College, Reading, as a result of the great damage done by mites to cheeses in England. Four species of mites attack cheese: — 1) *Carboglyphus anonymus* (in Cheddar); 2) *Tyto'lyphus siro* (in Stilton and Cheddar); 3) *T. longior* (*id.*); 4) *Aleurobius farinae* (*id.*).

The mites, their life history, and the experiments made on cheese infection are described, and methods of prevention and remedies given.

*Methods of prevention.* — 1) Perfect cleanliness of the rooms in which the cheeses are kept, and of all utensils and shelves used, the stopping up of cracks and crevices, etc.

2) Netting of windows and double doors.

8) Thorough disinfection of the rooms between the Stilton seasons; the whole room, especially all corners, window ledges, crevices, shelves and their supports, etc. should be washed with a 5 % carbolic acid solution.

4) It would be advisable to use short, movable shelves, preferably of glass, with iron supports and to have concrete floors with gutters for drainage.

*Remedies.* — 1) Filling the cheese room with steam vapour, and dipping the cheeses in hot water or formalin are useless as remedies.

2) Brushing the attacked cheeses daily and removing the mite dust considerably reduce the damage.

3) Fumigate the room with carbon bi-sulphide in the proportion of 1 lb. of bisulphide to every 500 cubic feet of space during August or September; there should be at least two fumigations, the second 12 or 14 days after the first, a third after the same interval is advisable. Painting the surface of the cheeses with bisulphide is the only way of freeing them entirely from mites; three paintings should be applied.

AGRICULTURAL  
PRODUCTS:  
PRESERVING.  
PACKING  
TRANSPORT,  
TRADE

583 - The Handling and Precooling of Florida Lettuce and Celery (1). — RAMSEY, H. J. and MARKELL, E. L., in the *U. S. Department of Agriculture, Bulletin No. 60*, pp. 28 + 11 Tables + 19 Figs. Washington, December 21, 1917.

In Florida the cultivation of lettuce and celery, now being grown over 4 000 acres, an area which is constantly increasing, brings into the growers about 1 500 000 dollars annually. As rot frequently causes serious loss, not only in the field, but also in apparently sound produce during transit, the Office of Horticultural and Pomological Investigations of the Bureau of Plant Industry of the U. S. Department of Agriculture undertook a series of investigations into the best commercial methods for reducing the losses which occur from the time the produce leaves the field till it is delivered to the consumer.

The experiments on lettuce were carried out in 1913-1915 near Palmetto, Manatee County, one of the largest lettuce-producing centres of Florida, those on celery at Palmetto and Manatee, chiefly during the spring of 1915. The rotting of lettuce during transport was found to be due prin-

(1) See R. Jan., 1918, No. 100. (*Ed.*).



cipally to lettuce drop (*Sclerotinia Libertiana*), a fungus which seems to enter the lettuce through the lower leaves.

The lettuce was cut just above the lowest 3 or 4 leaves, and all diseased leaves removed; such lettuce decayed much less during transit than that cut by the ordinary method. Produce in cars pre-cooled at the shipping point to 40°F. decayed much less during the journey than that in cars that had not been pre-cooled. Lettuce cut as described and packed in pre-cooled cars reached its destination in almost perfect condition and sold much better than that treated by the usual methods.

Celery is often injured in transit because it is packed too closely in the car to permit of proper circulation of the air and rapid cooling. Temperature records taken during transit in pre-cooled cars iced at the station and non-precooled cars kept iced throughout the journey, showed that non pre-cooled cars required about 4 days to reach as low an average temperature as that maintained by pre-cooled cars from the start. During the whole journey from Florida to the destination (New York) the temperature in the top row of cases never exceeded that in the lowest row by more than 5 or 6° in the pre-cooled cars, whereas in the non pre-cooled cars it amounted to 18° F. for a considerable time.

The cost of the pre-cooling and initial icing of a car of celery was less than that of full refrigeration throughout the journey. In hot weather it may be necessary to renew the ice once during transit, but this is not likely to raise the expense above that usually incurred for full refrigeration.

Pre-cooled celery reached the market in uniformly fresh condition, with the leaves of the top row almost as green as those of the lowest rows. The leaves in the top rows of non-pre-cooled celery were very yellow, decreasing the value of the whole load.

It appears that, during the latter part of the Florida celery-shipping season, the produce might be sold at a better price if stored for a short time. Pre-cooled celery was successfully stored during 4 weeks with very little decay, whereas non pre-cooled celery stored during the same time decayed considerably. Celery from the lower rows of a non pre-cooled car can be stored for a short time, but, during warm weather, that on the top row should be sold as soon as it reaches the market.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

584 — **Observations on the Damage Done to Trees by Tarring the Streets of Milan, Italy** (1). — BRIZI, U., in *Reale Istituto Lombardo di Scienze e Lettere, Rendiconti*, Series 2, Vol. L, Pt. 12-13, pp. 568-591. Milan, 1917.

As had already been noticed in France, England, and even in Italy, the author observed that tarring roads causes the death of the plants near them. Many of the observations made at Milan agree with those previously made, as regards both trees and plants in beds bordering on the tarred roads.

The most sensitive plants are *Æsculus Hippocastanum* and *Æsc. carnea* (= *Æsc. glabra*) the leaves of which, at the beginning of summer, turn rusty at the edge and curl up slightly, while their surface is covered with numerous small spots, which, at first, are yellow and as if covered with a thin layer of shining varnish. The leaf then curls up more and more, dries, and is easily torn and carried away by the wind.

Other conditions being equal *Platanus orientalis* is more resistant. In late summer the leaves, particularly the youngest and those of the lowest branches, are sprinkled with yellowish spots, which later turn into small, brownish, confluent marks with a shiny surface. The leaf is rarely completely covered with these spots, and, for that reason, does not often dry up altogether and fall.

Very sensitive are *Forsythia viridissima*, *Fagus laciniata* (= *F. sylvatica*) *Lagerstræmia indica*, *Taxus baccata*, *Spiræa solstitialis* (?), *Cornus*, *Deutzia*,

(1) See B. Dec., 1910, p. 391; B. Jan., 1911, Nos. 281 and 282; B. Feb., 1911, No. 592; B. May, 1911, No. 1522; B. July, 1911, No. 2271; B. Nov.-Dec., 1911, No. 3227; B. June, 1912, No. 967; B. Feb., 1913, No. 184; B. May, 1913, No. 522. (Ed.)

*Magnolia grandiflora*, etc., and, of the herbaceous plants, *Lamium*, *Stellaria*, etc. Field grasses are more resistant.

The injury is caused almost exclusively by the very fine dust raised by the passage of motor cars along the tarred roads. This dust settles slowly and is most abundant on low plants and the lowest branches of trees, and less abundant on high branches. This was confirmed by a set of experiments on both herbaceous and woody plants (*Chrysanthemum*, *Primula sinensis*, *Cineraria*, *Dahlia variabilis*, *Fuchsia*, *Canna indica*, *Pelargonium zonale*, *Hordeum vulgare*, *Lolium*, *Festuca*, *Aloë margaritifera* (= *Haworthia margaritifera*), *Echeveria metallica* (= *Cotyledon gibbiflora*), *Crassula*, *Nephrodium*, *Pteris*, *Hydrangea*, *Forsythia viridissima*, *Syringa vulgaris*, *Spiraea solstitialis* (?), *Æsculus*, *Fagus purpurea*, *Tilia*, *Ulmus effusa*, *Acer Pseudoplatanus*, *A. Negundo* (= *Negundo aceroides*), *Phoenix*, *Trachycarpus*, *Kentia*, *Laurus nobilis*, *Thuya*, *Cupressus*, *Araucaria*, *Platanus orientalis*).

The harmful action of the dust is due, if not exclusively, at least largely, to the action of the vapours given off by the small particles of tar it contains when it is strongly heated by the sun. No other explanation can be given of the fact, observed in nature, and absolutely clear and indisputable in the experimental tests, that on the same plants, covered with the same amount of dust of the same quality, marked and serious lesions occur only in the parts reached by the sun and are more intense and rapid in growth in proportion as the period of insolation is prolonged, and, consequently, the temperature is higher. Plants exposed in the shade, or not reached directly by the sun, never suffer perceptible injury. The soluble compounds contained in the particles of tar cannot be considered to be direct causes of the injury, chiefly because these particles are insoluble, and, secondly, because even if some injurious substances could be dissolved by rain, this would not explain why the lesions only appear in the parts exposed to the sun. On the other hand, rain, though only light is favourable, because it washes the leaves free from dust.

The best remedy lies in a rational, regular and abundant watering of the tarred roads, which would remove the dust, especially when it accumulates after long droughts. It is probable that the slight damage hitherto observed in England is due, not only to the use of a better quality tar — it is not the crude tar from the gas-works as in France and Italy, but a special refined tar — but to the fact that all the tarred roads on which there is much traffic are not only watered daily, but are well washed by powerful streams of water which prevent the dust from accumulating. Care should also be taken to choose for shaded roads trees or plants little subject to the action of tar.

To avoid serious injury when the boiling tar is applied the operation should be carried out by preference during the period of vegetative rest, or before the plants begin to grow, *i. e.*, at the beginning of spring, never in the middle of summer. By these means and by copious periodical watering the damage may be considerably reduced, but doubtless the only way to avoid it altogether is to replace tarring by another method of coating roads. At Milan it was observed that the use of asphalt or "San Valentino bitumen" gives rise to none of the damage to plant life caused by tar.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

## GENERAL

585 — **Rusts and Smuts Collected in New Mexico in 1916.** — STANDLEY, PAUL C., in *Mycologia*, Vol. X, No. 1, pp. 34-42. Lancaster, Pa., January, 1918.

The list contains about 60 species of rusts and 5 species of smuts, collected chiefly by the author in August and September, 1916, at Ute Park, Colfax County, in the extreme north of New Mexico, at an altitude of about 2 350 metres. Many of the species are new to the State, several others were found on hosts hitherto unreported for New Mexico. The rusts were determined by Dr. J. C. ARTHUR, the smuts by Mr. H. R. Rosen.

Among the rusts are *Coleosporium ribicola* (Cooke and Ellis) Arthur (*Peridermium ribicola* Long), very abundant on *Ribes aureum* Pursh., *R. inebrians* Lindl. and *Grossularia inermis* (Rydb.). Cov. and Britt, all new hosts for the State. The fungus was also found at Ute Park on a leaf of *R. Wolfii* Rothr. In the North American flora this rust is reported neither on *G. inermis* nor on *R. Wolfii*. LONG reported its aecidial stage on *Pinus edulis* Engelm., from the Sandia Mountains. He also reported the coleosporial stage on *R. mescalegium* Coville, in the Santa Fe National Forest; the host was probably rather *R. inebrians*, because according to the author, *R. mescalegium* is confined to the south of the State. LONG also noted the coleosporial stage in Albuquerque on *R. longifolium* (*longiflorum* ?), a name which should doubtless be corrected to *R. aureum*; *R. longiflorum* is not known to occur in New Mexico.

Among the smuts are mentioned *Ustilago Hordei* (Pers.) Kell. and Swingle on cultivated *Hordeum trifurcatum* Jacq., and *U. levis* abundant on cultivated oats.

586 — **Brazilian Fungi** (1). — RANGEL, E., in *Archivos do Jardim Botânico do Rio de Janeiro*, Vol. II, pp. 69-71 + 3 Plates. Rio de Janeiro, 1918.

The list includes :—

- 1) *Puccinia grumixamae* Rangel n. sp., on living leaves of *Eugenia brasiliensis*, in the Botanical Garden of Rio de Janeiro;
- 2) *P. cambucae* Puttemans; the host of this fungus described previously is *Marlierea edulis*, not *Myrciaria plicato-costata*;
- 3) *S. Simasii* Rangel n. sp., on leaves, petioles and twigs of *Breweria Burchellii*, at Icarahy, near Niteroy;
- 4) *P. paulensis* Rangel n. sp., on leaves and twigs of *Capsicum annuum*, at S. Paolo;
- 5) *Laestadia cambucae* Rangel; the host of this fungus is *Marlierea edulis*, not *Myrciaria plicato-costata*;
- 6) *Septoria Miconiae* Rangel n. sp., on living leaves of *Miconia* sp., at Niteroy;

(1) See *B.* Jan., 1912, No. 11; *B.* June, 1913, pp. 876-879; *B.* Oct., 1913, No. 1216; *B.* Dec. 1913, No. 1401; *B.* Jan., 1914, No. 78; *B.* Aug., 1915, Nos. 859 and 861; *R.* Apr., 1918, No. 493. (Ed).

7) *Cercospora Genipae* Rangel, n. sp., on living leaves of *Genipa* sp. (*G. americana*?) at Rio de Janeiro; .

8) *Helminthosporium Manihotis* Rangel, n. sp., on living leaves of *Manihot Aypi*, at S. João Nepomuceno (Minas Geraes);

In 1915 the author described a new genus of hyphomycetes, which he called *Velloziella*; so as to avoid confusion with the similarly named genus of Scrofulariaceae, he has changed the name of the genus he formed to *Mycovellosiella*.

A description of the species new to science is given in Latin.

587 - **Fungi of the Philippine Islands.** — YATES, H. S., in *The Philippine Journal of Science, Section C., Botany*, Vol. XII, No. 6, pp. 361-380 Manila, 1917.

This paper gives a list of 78 species of fungi collected during recent years in various districts of the Philippines. Many are new to science and, in this case, are accompanied by a description in Latin.

It is interesting to note that the genera *Meliola* and *Asterina* are particularly numerous. This may be explained in part by the fact that representatives of these two genera are mostly not very remarkable forms which may have escaped previous investigators. In the Philippines the *Meliola* genus includes a larger number of known species than any other genus of Ascomycetes, second place in this respect being held by the genus *Asterina*. The list given by the author includes 21 species of *Meliola*, 17 of which are new to science, and 10 species of *Asterina*, 6 of which are new.

Among the various fungi enumerated are:—

- 1) *Meliola catubigensis* n. sp., on leaves of *Loranthus*;
- 2) *Asterina colliculosa* Speg., on leaves of *Eugenia Jambolana*;
- 3) *Actinodothis Piperis* Syd., on leaves of *Piper retrofractum* and *Piper* sp.; a fungus very common in the Philippines; in some places practically all the *Piper* plants are attacked;
- 4) *Cercospora personata* Syd., on leaves of *Arachis hypogaea* (1);
- 5) *Hadronema orbiculare* Syd., very common on living leaves of *Quercus* sp.; it is one of the few fungi which have only been reported from Japan and the Philippines.

588 - **Plants Resistant to Diseases, Pests and Adverse Meteorological Conditions.** — See No. 519 of this Review.

589 - **Mineral Anticryptogamic Compounds Produced in Spain.** — See No. 509 of this Review.

590 - **Comparison of the Effects of Copper Mixtures and Acid Mixtures on Mildew of the Vine.** — CAPUS, J., in *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. IV, No. 2, pp. 86-90, Paris, 1918.

In 1917 the author undertook experiments in the experiment field of Cadillac (Gironde) and the laboratory of the Plant Pathology Station of the Department of Gironde, on the comparative effects of the following mixtures:—

RESISTANT  
PLANTS  
  
MEANS  
OF PREVENTION  
AND CONTROL

(1) See R. March, 1918, No. 350 (Ed.)

a) basic Bordeaux mixture, according to the formula of MILLARDET and GAYON, with 2 % copper sulphate ;

b) acid Bordeaux mixture prepared by the PICKERING and SICARD method, with the same quantity of copper sulphate ;

c) basic Bordeaux mixture, prepared by PICKERING'S method, i. e., with lime water and 2 % copper sulphate ;

d) acid Burgundy mixture, prepared by FONZES-DIACON'S method ;

e) 2 % neutral Burgundy mixture.

The results obtained showed the acid and basic mixtures to be equally efficacious against mildew of the vine, but that for a period exceeding 20 days and during heavy rains, basic mixtures retain their efficacy better than acid ones.

591 - Patents for the Control of Diseases and Pests of Plants. — See No. 566 of this Review.

DISEASES  
OF VARIOUS  
CROPS

592 - *Pseudomonas Tritici* n. sp., Injurious to Wheat in the Punjab. — HUTCHINSON, C. M., in *Memoirs of the Department of Agriculture in India, Bacteriological Series*, Vol. 1, No. 7, pp. 160-175 + 4 Plates. Calcutta, October, 1917.

A bacterial disease of wheat, called locally "Tannan" or "Tandu", has long been known in the Punjab. Its principal characteristics are very similar to those described by RATHAY (1) and O'GARA (2) for *Dactylis glomerata* and *Agropyron Smithii* respectively.

The inflorescences and part of the stem are covered with a bright primrose yellow slime or gum, forming adherent, sticky layers between the glumes and between the stem and sheath. This slime is composed of masses of bacteria, and the outer, exposed parts become dry, hard and flaky, and, at the same time, turn a deeper yellow. A frequent characteristic of the disease, due to obstruction of the growth of the plant by the sticky bacterial masses, is the distortion of the stem immediately below the head.

Although the disease has appeared in the same district (Montgomery) of the Punjab every year since 1908, with the sole exception of 1915, and is said to have been known there many years earlier, it does not appear to be of serious importance at present as it only attacks a very small percentage of plants, and only those in soil rendered infertile by bad cultivation and bad drainage.

The occurrence of the disease must, however, be carefully and continually observed to prevent an eventual increase of parasitic activity and a wider distribution of the pathogenic agent, although the disease seems at present to be limited by natural causes — dry air and high soil temperature — to the only part of India in which it is as yet known. As these causes vary only in abnormal seasons, it seems that, in the Punjab, the disease would only form a serious obstacle to wheat-growing if the irrigation water were applied unjudiciously, or if a new variety of wheat, more subject to attack by the parasite, were introduced. The damage might also increase if the bacterium were to acquire higher parasitic power or resistance to adverse climatic conditions.

(1) See R. Nov., 1917, No. 1093. — (2) See R. Feb., 1916, No. 212. (Ed.)

The disease may be spread either by bacteria persisting in the soil or by those carried on the grain or chaff of the plant; this should be remembered when using seed wheat from infected districts.

The causal bacterium is described in detail under the name of *Pseudomonas Tritici* n. sp. It is probable, as in similar cases, that eelworms play an important part in spreading or accentuating the disease.

In the inoculation experiments at Pusa bacterial growth on the wheat could only be obtained under a bell-jar, which ensured sufficiently moist air and the formation of dew on the plant. The rapid growth of the wheat, however, not only made it impossible to observe the full effect of the parasite, but appeared to prevent the characteristic distortion of the stem observed in the Punjab fields.

No positive results were obtained with inoculation of other Gramineae, but considerable bacterial growth was obtained on living onion bulbs. Onions were chosen because of the many points of resemblance in the morphological, cultural, and physiological characters of the wheat bacillus and *Ps. Hyacinthi* Wakker. The onion is the plant most closely resembling the hyacinth obtainable in the plains of East India.

In view of the relatively small percentage of wheat attacked by the disease, the only methods of control which need be emphasised for this as for other bacterial diseases of plants are good drainage and careful cultivation.

593 — **Bacterial Blight of Barley.** — JONES, L. R., JOHNSON, A. G. and REDDY, C. S., in the *Journal of Agricultural Research*, Vol. XI, No. 12, pp. 625-643 + 2 Figs. + 4 Plates. Washington, D. C., December, 17, 1917.

This paper describes a bacterial disease of barley (*Hordeum* spp.) which was first observed in 1912 doing considerable damage to two-row Montana barley (*H. distichon*), and later on common six-row varieties (*H. vulgare*), at Madison, Wis. Since then it has appeared each year in the same district and has also been reported from other parts of the United States.

The disease principally attacks the leaves, where it forms small water-soaked areas, which enlarge later into translucent yellowish or brownish blotches or stripes. Similar lesions may also appear on the glumes.

A bacterial exudate may appear on the lesions in the form of tiny, clouded drops, which harden into yellowish resinous granules or form a grayish flaky, surface film. This exudate and translucency of the infected parts distinguish the bacterial blight from diseases caused by *Helminthosporium*. The disease is somewhat similar to those caused by *Aplanobacter Rathayii* E. F. S., *A. Agropyri* O'Gara, and *Pseudomonas Avenae* Manns, but is nevertheless distinct from each of them.

The primary lesions may appear very early on the young plants, and the secondary lesions when the plants are from 8 to 10 inches high. Later the disease develops with increasing rapidity.

The disease is very widespread, from the Mississippi Valley to the Pacific coast. It attacks the two row (*H. distichon*), common six-row (*H. vulgare*), and erect six-row (*H. hexastichon*) barleys. The varieties of these three groups are not all equally susceptible to infection; some appear to be

naturally immune, but nothing definite can be stated till further work on the subject has been carried out

The pathogenic agent is present in great numbers in the invaded tissues and the exudate. It is a monotrichic bacterium, yellow in culture, which the authors believe to be new to science and describe under the name of *Bacterium translucens*. Not only has it been isolated from infected tissues and the exudate, but also from dry leaves, kept throughout the winter, and from grain 2 years old.

Inoculation experiments have shown that the disease may easily be reproduced in barley by spraying with water containing the bacterium in suspension. Negative results were obtained by inoculations of oats, rye, wheat, spelt, emmer, einkorn and timothy. The bacterium enters the host through the stomates and intracellular spaces

Although the bacterium may hibernate in infected leaves there is no doubt that diseased grain is the principal factor in spreading the parasite and the seat of spring infection. The most efficacious means of control known at present consist in avoiding infected seed and in doubtful cases, disinfecting it.

594 - **Diseases of Cabbage in the United States.** — HARTER, L. L. and JONES, L. R., in the *United States Department of Agriculture, Farmers' Bulletin* 925, 1 p. 30 + 13 Figs. Washington, D. C., January, 1918.

After observations on the spread of diseases of cabbages and other cultivated Cruciferae and the methods of controlling them, the author describes the most important of these diseases, nearly all of which are caused by vegetable parasites. They are:—

1) Clubroot (clubfoot, finger and toe), caused by *Plasmodiophora Brassicae* Wor.;

2) root-knot (*Heterodera radiculicola* [Greef] Müll.);

3) black-rot (brown-rot, stem-rot, dry-rot) caused by *Bacterium campestris* (Pammel) Erw. Sm.;

4) yellows (yellow-sides, wilt, dry-rot), caused by *Fusarium conglutinans* Wollenw.;

5) black-leg (foot-rot, wilt), a disease caused by *Phoma lingam* (Tode) Desmar.;

6) soft-rot, caused by soft-rot bacteria, of which *Bacillus carotovorus* Jones is a typical example;

7) root-rot (wilt), a disease of non-bacterial origin caused by asphyxia of the plant due to stagnant water;

8) malnutrition, a disease due to excess of chemical fertilisers and a deficiency of humus in the soil;

9) downy mildew (*Peronospora parasitica* [Pers.] De By.);

10) white-rust (*Albugo candida* [Pers.] Ktz. = *Cystopus candidus* [Pers.] Lev.);

11) drop (*Sclerotinia Libertiana* Fuck.);

12) spot disease of cauliflower, a new disease caused by a bacterium which appears to attack only *Brassica oleracea* and *B. oleracea* f. *Botrytis*;

13) black leaf-spot (black mould); the most common form of thi-



disease is caused by *Alternaria Brassicae* (Berk.) Sass., but other related fungi may cause similar leaf-spotting, and yet others may contribute to moulding the plants in storage deposits ;

14) powdery mildew (*Erysiphe Polygoni* D. C.) ;

15) damping-off, a disease which chiefly attacks young plants in seed-beds, and which may be caused by several species of fungi.

**595 - *Pseudomonas seminum* n. sp., a Bacterium Injurious to Peas, in England.**

— CAYLEY, DOROTHY M., in *The Journal of Agricultural Science*, Vol. VIII, Pt. 4, pp. 461-479 + Plates IV-VII. Cambridge, 1917.

Crops of *Pisum sativum* grown near the John Innes Horticultural Institution, Merton, Surrey, are badly damaged by a bacteriosis which, having appeared in a particularly serious form from 1910 to 1912, was found later in other districts in the south of England. The same disease was found in 1915 on peas from Sleaford, Lincoln. An examination of samples from various districts showed that this bacteriosis tends to spread more and more.

The author proposes to call the bacterium, which has not yet been described, *Pseudomonas seminum*, and gives details of its morphology and biology.

The chief characteristic of the disease is that it occurs within the seed, discolouring the centre of each cotyledon. External examination does not show if the seed is diseased or not. The bacteria cannot penetrate the ripe tissues, so that infection, found only in the lesions of the very young tissues, takes place long before it is shown by discolouration of the tissues.

The bacteria is found in all parts of the plant except the vessels, in which it has never been observed. It has been isolated from the interior of both the dry and fresh seed, from the stem and the pod. It has never been seen to pass the micropyle although, in one case, it was found in the space between the cotyledons and the young embryo.

All varieties of table peas seem more or less subject to the disease. The most resistant variety is Sutton's Improved Petit Pois, which when sown in infected soil, produced 49 to 50 % of sound plants, the seeds of which, sown in the same soil the following year, produced 50 % of sound plants. The Duke of Albany and Nec Plus Ultra varieties are very subject to the disease, the number of healthy plants in the first variety was, at the most, 14 to 15 %, and cultivation of the second at Merton for Mendelian experiments had to be stopped because of its great susceptibility. Tall, early varieties are much less attacked than late ones ; this appears to be due to their less succulent vegetative apparatus, and their more rapid growth, which allows them to become sufficiently mature before external conditions determine a rapid development of the bacteria.

The author examined many varieties of early peas grown at Wisley in 1915. All the plants were nearly ripe. One variety only showed the typical discolouration of the cotyledons, although, judging by the external appearance, there were many doubtful cases. A row of Duke of Albany grown in an adjacent plot, but in a much more advanced stage of develop-

ment showed the typical discoloured area in the centre of the cotyledons. Infection was more marked at Merton than at Wisley, where it was probably introduced by seed.

Of the dwarf, succulent early varieties, Chelsea Gem and Little Marvel, and, of the later types, Nec Plus Ultra and Duke of Albany, are especially subject to the disease.

The bacteriosis does not stop germination, but, in serious cases, it delays the growth of the plant by killing the whole main stem and preventing the development of lateral shoots.

So far no means of controlling the disease are known. As precautions may be recommended crop rotation, early seed, drainage, a sufficiency of lime in the soil, elimination of seed from diseased plants. Infected plants and their props should be burnt as soon as the harvest is gathered. Partial sterilisation is of no use, and involves too much work and excessive expense. Special care should be taken to clean thoroughly all tools used in infected soil so that the disease may not be spread by them.

596 - *Verticillium albo-atrum* a Hyphomycete Causing "Vissnes Juka" (Wilt) of Cucumber in Sweden. — LINDFORS THORE, in *Kungl. Landbruks Akademiens Handlingar och Tidskrift*, Year LVII, Nos. 7-8, pp. 627-636 + 3 Figs. Stockholm, 1917.

In 1916, in a field of cucumbers at Ballersta, Södermanland, plants which were sound and strong till the end of July, were attacked by wilt, of which the majority died. A microscopical examination of the infested material showed the existence within the stem tissues of masses of mycelium which more or less completely closed up the vessels, thus preventing the passage of the water from the roots. While the host lives the parasitic mycelium is restricted to the vascular bundles, and only invades the surrounding tissues after the death of the plant.

In cultures made from infested material 3 fungi were identified: — 1) *Verticillium albo-atrum*; 2) *Ascochyta Cucumis*; 3) *Fusarium nivium* (?) in one case only and even then it was not possible to isolate it.

The following results were obtained from infection experiments, in which *Fusarium sclerotioides* and *F. redolens* var. *angustius* were used in place of the allied *Fusarium* species which could not be isolated from the material:—

1) *Ascochyta Cucumis* produces in the cucumber spots on the leaf, but no wilt;

2) *Fusarium sclerotioides* and *F. redolens* var. *angustius*, do not cause wilt, but, in certain cases, may give rise to a kind of stem-rot;

3) *Verticillium albo-atrum* is the only and the real specific agent of wilt; its hyphae easily enter the living tissues of both mature and young plants, and develop in large number in the vessels, which they stop up more or less completely.

Up to the present, apart from Ballersta, the disease has been reported from the districts of Stockholm, Nyköping, Västmanland and Örebro. Though the damage done is slight the possibility of further, more extensive infection, calls for a study of the methods of control.

The author suggests, in the first place, the uprooting and destruction of diseased plants, care being taken to remove all the soil with which such plants may have been in contact. Dead plants left in the field rapidly become seats of infection. In infected districts neither cucumbers nor potatoes should be grown for several years. The soil should be disinfected. The author believes that for this purpose good results could be obtained with formalin; tests with 2 % potassium permanganate solutions had no effect.

597 - On "Verde-secco" of Fruit Trees in Apulia, Italy. — VIVARELLI, I., in *La Propaganda Agricola*, Series 2, Year X, No. 5, pp. 51-55. Bari, March 15, 1918.

In Apulia the name "verde-secco" is given to a serious disease by which many woody plants (almond, olive, apricot, myrobalan, and peach trees, etc.) pass with great rapidity from a state of normal and flourishing development to a very grave disorder followed by death. First the leaves dry up, then the smallest twigs, then the branches, and, finally, the trunk itself.

Field observations and experiments carried out by the author in different parts of Apulia (Andria, Canosa, Barletta, Casamassima, Trani, Molfetta), showed no plant or insect parasites in the epigeal part of the plant, but proved the root system of all, or nearly all the plants killed by "verde-secco" to be attacked by a rot caused by *Rosellinia necatrix*. The disease is favoured by certain conditions, such as heavy and impermeable soil, prolonged stagnation of rain water, badly executed plantation, the custom of digging, at the foot of the plant, a central hole to receive water instead of a circular ditch in proportion to the foliage, the re-planting of trees in the place of those recently killed by the rot.

According to the author, a plant the root system of which is seriously affected by the rot, has difficulty in maintaining the balance necessary to the complex working of its vegetative organs, and when by a sudden, high rise in temperature, especially during fine days, transpiration is considerable, it cannot counterbalance it by an equal intensity of root absorption and dies. By allowing the plant to develop its root system well and to keep it healthy the damage described above would certainly be avoided.

598 - *Monilia* sp., the Cause of a Specific Gummosis of the Apricot Tree, in Italy. — PEGLION, V., in *Rendiconti della Reale Accademia dei Lincei, Classe di Scienze fisiche, matematiche e naturali*, Series V, 1st. Half-Year 1917, Vol. XXVI, Pt. 12, pp. 637-641. Rome, 1917.

In Emilia apricot growing is seriously threatened by a form of gummosis, which, already noted incidentally by BEIJERINCK and ERIKSSON, had been reported by FAES as very injurious to apricot trees in Valais, Switzerland, and by CHIFFLOT and MASSONNAT to those of the Rhone district (1).

The disease is caused by a conidial form (*Monilia*) of a *Sclerotinia* which, according to the author, would correspond to *Scl. laxa* if the differential characters observed by ADERHOLD and RUHLAND were sufficient to distin-

(1) See *B.* Oct., 1915, No. 1098. (Ed.)

guish this parasite from *ScL cinerea*. The most significant character is the absolute restriction of parasitism to the apricot tree, which is also observed in the Emilian orchards.

The first signs of infection occur during flowering; some of the flowers fade and dry up, but do not drop. Later, when the leafy shoots are longer, the wilt suddenly attacks, from one day to another, the buds corresponding to these flowers. Above the point of insertion of these buds, sometimes at a distance of a few nodes, especially during rainy seasons, a gummy stream of transparent drops is noticed flowing from the cracks of the bark and forming lumps more or less large in size. A more considerable gummosis is observed on the adult branches and even on the trunk corresponding to a faded adventitious floral bud. The infection of the growing fruit is very limited; most frequently fruit is infected which has grown in contact with a mummified flower spotted with gum.

The rapid spread of infection which may occur seems to correspond to an early and rather long flowering period during which insects, by visiting infected flowers, carry conidia of *Monilia* and spread disease by visiting sound flowers.

This disease must be controlled by systematically destroying the parasite's hibernation quarters. It is not sufficient to burn the mummified fruit, which may easily be found and collected in winter; it is against the blisters formed by the fungus hibernating under the remains of flowers, on the twigs killed by the disease, and the fragments of bark covering the cankers of the adult branches and trunk that measures must be taken. It is easily suppressed by careful pruning when vegetation starts and the localised injuries on the tree can be seen without difficulty, so that the tree may be cured before the winter period of rest. The cankers heal normally, and infection in them is limited to the more or less fragmentary remains of bark, which may easily be removed by superficial scraping.

**599 - Treatment of *Fusicladium pirinum* var. *Eriobotryae*, Injurious to the Japanese Medlar Tree.** - SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura in Acreale, Bollettino*, No. 29, pp. 6 + 2 Figs. Achade, 1917.

In the east of Sicily a disease called "brusone" by the author, who has observed it for 8 years, is developing with increasing virulence on the branches, leaves and fruit of the Japanese medlar tree (*Eriobotrya japonica*). It is caused by *Fusicladium pirinum* (Iib.) Fuck. var. *Eriobotryae* Scal.

On the medlars is observed a small, blackish spot, which gradually increases. The attack of the parasite may begin in December and continue till February or March.

If the fruit is attacked during the first stage of its development it becomes deformed, and shrivels, the spot grows, and the fruit dries up and becomes mummified. If attacked during ripening, this stage remains imperfect. The infected branches are twisted, stunted, spotted with black, and with irregular, shrunken leaves; they fade and dry up from year to



Those trees which have the largest and sweetest fruit are most subject to attack by the fungus.

The author's experiments on winter treatment showed the efficaciousness of spraying with lime-sulphur mixture made according to the formula of the "Stazione di Agricoltura" (lime, 2 lb.; sulphur, 4 lb., water, 2 gall.). The mixture should be applied in 12 % strength, at the most 14 %, in December, when all the flowers have fallen, and in January.

The trees to be treated should be pruned in August, during the resting period, so as to remove the branches, in which the parasite passes the summer, and to give strength to the tree. The pruned branches should be burnt at once. It would be well to undertake experiments to prove whether 6 % sprayings in summer to destroy the parasite in the branches would be advisable.

**600—The Tumours of the Cluster Pine (*Pinus Pinaster*), in France.** — DE FREN OV, J., in *Comptes rendus des séances de l'Académie des Sciences*, Vol. CLXVI, No. 8, pp. 355-356 Paris, February 25, 1918.

The cluster pines of the Arcachon forests have many tumours on their stems and roots. On the one year stems the tumours are cankerous and exude abundant resin which flows down the stem. The old tumours may close and form lumps appearing as knots, more or less resinous on the surface.

After describing the structure of the tumours, the author draws attention to the masses of bacteria found in the diseased tissues. A very fine mycelium, which often lives on the surface of the resin exuded, may enter the cankerous tissues by the parts rendered resinous by the bacteria. This mycelium, however, is only an adventitious organism.

The author isolated the bacteria observed in the infected tissues. After 3 days at 12° C. when the tumours were one year old, and after 5 days when the tumours were older, cultures made with the tissues of the stem tumours develop very dense, greyish colonies, forming a slight veil over the surface of the agar, which they liquefy. The mycelium from the resin often grows in tubes at the end of 8 days, forming whitish colonies, quite distinct from those of the bacteria. At the end of 8 days cultures made with the tissues of the root tumours develop white colonies which become very dense and thick and grow on, or just below, the surface, without liquefying the agar.

Under the microscope the bacterial colonies from the stem appear to be composed of bacteria resembling those observed in the stem tumours. The colonies from the roots are composed of much larger bacteria than those from the stem and resemble those of the root tumours.

The stem and root tumours of *Pinus Pinaster* appear to be due to two different bacteria, the characters of which the author will publish later. The bacterial tumours of the stem of the cluster pine differ from those of the Aleppo pine which have long been known.

601 — *Phyllactinia suffulta*, an Ascomycete Injurious to Common Oak, in Spain.

— ROBREDO, L. H., in *El Cultivador Moderno*, Year VIII, No. 3, p. 12. Barcelona, 1918.

For some time *Phyllactinia suffulta* has been spreading in the plantations of common oak in Galicia, depreciating the value of the tree for the various uses to which it is put.

As a preventative measure, to lessen the intensity of the disease during the following year, it is advisable to burn the infected fallen leaves in autumn, an operation which must be carried out simultaneously in all the neighbouring oak plantations. Sulphur treatment should also be carried out when the young shoots are about 4 inches long. This treatment should be carried out in dry weather and repeated 20 days or a month later if the white spots of the disease continue to appear on the leaves. The treatment costs about 2*d.* for an average sized tree and 4 ½ *d.* for a large tree.

Observations and experiments show that trees which are not pruned are not attacked by the fungus, that those pruned a little, are attacked slightly, and that those which are excessively pruned are badly attacked. *Quercus palustris* and *Q. rubra* var. *americana* are the varieties most resistant to the fungus.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### GENERAL

- 602 — Biological Observations on some Coleoptera of the Department of Hérault, France (1). — LICHTENSTEIN, J. L., in the *Bulletin de la Société entomologique de France*, No. 4, pp. 91-95. Paris, 1918.

Special mention should be made of :—

*Anthaxia aurulenta* Fabr. — An insect found on the elm, and, according to CAILLOL, especially on the small trunks of young, dead elms. Nevertheless in April the author found several specimens of this *Anthaxia*, which seems very rare in the Department of Hérault, on young branches of *Salix alba*.

*A. manca* L. — Common on the elm and also known to occur on certain other trees, has not previously been reported on *Rhamnus Alaternus* (barren privet) on the branches of which the author found it in June and July.

*Scobicia chevrieri* Villa. — Not rare on branches of fig trees, this insect is also a host of branches of vine and barren privet.

*Stromatium fulvum* Villers. — The author received from the province of Constantine, Algeria, branches of cork-oak containing larvae of this species which, in the Department of Hérault, develop on young elm. He obtained adult insects after 5 to 6 years (according to MAYET the larval state may last for 15 years.) In some bits of branch, about 5 inches long, several larvae had developed, hollowing wide galleries throughout the sap-wood, which were so filled with excreta that they were almost as hard as the wood. Although this insect is common in cork-oak forests, it does little damage.

*Exocentrus punctipennis* Muls. — In Languedoc its larvae are found under the bark of white willow and elm.

(1) See R. March, 1918, No. 366. (Ed.)

*Hylesinus vittatus* Fabr. and *Scolytus multistriatus* Marsh. — These two insects of young elms also attack branches of *Rhamnus Alaternus* L., hollowing their galleries under the bark, where *Sc. multistriatus* is attacked by two braconidae—a species of *Ecphyllus* which will be described shortly, and *Dendrosoter protuberans*. *Hyl. vittatus* continually bears on its sides numerous mites not yet determined.

*Rhytidoderes plicatus* Oliv. — According to BEDEL this insect lives at the foot of *Reseda lutea*. It also seems to attack Cruciferae; the author found one eating a leaf of *Diplotaxis tenuifolia* in April, and another on cultivated cabbage.

*Derolomus chamaeropsis* Fabr. — Abundant on specimens of *Chamaerops humilis*, cultivated at Montpellier, particularly in the Botanical Garden. According to PERRIS the egg is doubtless laid in the ovaries, but the author has only observed this insect on the male flowers of the palm.

*Choerorhinus squalidus* Fairm. — PERRIS reported it on elm and the fig-tree. The author found it in small numbers on the dead part of a fig-tree trunk which had been invaded by ants (*remasiogaster scutellaris*); this insect is, however, by no means myrmecophagous; when it established itself in the trunk the ants had already left it.

*Eremotes punctatulus* Boh. — Dead ash wood, in which the author found larvae, pupae and adults, may serve as food to this insect which has already been observed on several species of trees.

*Mononychus punctum-album* Herbst. — It is very common at Montpellier on *Iris Pseudacorus* and *I. foetidissima*; the author knows, in rather dry soil, several of the latter, the fruit of which are eaten by the insect each year. He found large numbers of the *Mononychus* on different cultivated varieties of *I. germanica* and *I. florentina*.

603 — *Perezia legeri* n. sp., a Protozoan Parasite of the Larvae of the Large White Cabbage Moth (*Pieris brassicae*) (1). — PAILLOT, A. in *Comptes rendus des séances de la Société de Biologie*, Vol. LXXXI, No. 4, pp. 187-189 + 1 Fig. Paris 1918.

This paper describes a new microsporidion temporarily placed in the genus *Perezia* under the name of *P. legeri* n. sp.

It is found especially in the adipose tissue of the larva of *Pieris brassicae* and in some of the giant cells of its blood. In the rather rare cases of generalised infection the spores of the protozoon are found in all the tissues of the larva of the insect.

604 — *Leptocoris varicornis*, a Weevil Injurious to Rice in Assam. — Report of the Agricultural Department, Assam, for the Year ending the 30th June, 1917, pp. 5. Shallog, 1917.

At Jaintia Perganas and the Karimgary farm in Sylhet, *Leptocoris varicornis* (rice bug) has done considerable damage to rice. The early varieties suffered most. The results of the experimental harvest showed the loss to amount to 90 % of the normal yield.

605 — Experiments on the Disinfection of Dwarf Beans Infested with *Acanthoscelides obtectus* and *Spermophagus subfasciatus*. — PANTANELLI, E., in *Le Stazioni sperimentali agrarie italiane*, Vol. I., Pt. 11-12, pp. 591-609. Modena, 1917.

Part of a consignment of dwarf beans imported from Brazil in May,

MEANS  
OF PREVENTION  
AND CONTROL

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

(1) *Sec R.*, May 1918, No. 37<sup>a</sup>. (Ed.)

1917, on arrival in Italy, was found to be already slightly infested with *Acanthoscelides obtectus* (1), and much more seriously by another weevil *Spermophagus subfasciatus* (= *Sperm. musculus*), peculiar to South America and hitherto met with only once in Europe (Paris), where it did not increase.

The author undertook experiments on the disinfection of the seed and the store-houses. He ascertained that to cause the certain death of the adult insects in the seeds, each hundredweight of dried beans should be treated for 48 hours with fumes given off by either 50 gm. of carbon bisulphide, by about 50 cc. of carbon tetrachloride (= 81.54 gm.) or by 0.5 gm. of potassium cyanide. The germinating power of the seeds is more affected by the bisulphide than by the tetrachloride, but is not affected at all by the potassium cyanide.

The store-houses may be satisfactorily disinfected by spraying with an emulsion of tar oil.

Among the preparations tested the author recommends "lysol", made by Schülke and Mayr, "cresosol" made by the Society for the distillation of tar (Società Distillerie Catrame), "creselion" made by Carlo Erba, and "creoline" prepared by G. Pearson.

Experiments made in October on *Ac. obtectus* and *Sperm. sub-fasciatus* at temperatures of from 12 to 15° C., showed that, to kill completely adult insects within the seeds the following proportions are needed:—

creoline . . . . .	7	volumes in	100	volumes of water
creselion . . . . .	6	"	"	"
cresosol . . . . .	5	"	"	"
lysol . . . . .	4	"	"	"

**606 — Observations on *Acanthoscelides obtectus* (Bean Weevil), in Italy. —**

RAZZAUTI, A., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 94-122 + 16 Figs. Portici, 1917.

Very little work has been done on the presence of *Acanthoscelides obtectus* Say ("tonchio del fagiuolo") and the damage it does to runner and dwarf beans, although this insect has been known in the country for about 20 years. The present investigations were, therefore, undertaken in an attempt to learn more about the "bean weevil"

A list of the synonyms of the insect is followed by a morphological and biological description. According to some workers the insect is a native of Persia or Armenia, according to others of Northern America, and is so widely distributed geographically that it may almost be considered cosmopolitan. SHARP reports it from the following districts: — North America to the east of the Rocky Mountains, Mexico, Guatemala, Nicaragua, the Antilles, and the Argentine (Buenos-Aires). It is also found in Australia, the Azores Islands and the Canary Islands. In Europe, according to the author, *A. obtectus* is known in England, France and Italy. BERTOLINI reports it from the Alpes Maritimes and the Mediterranean district; MINÁ PALUMBO reports it from Genoa, Naples and from Sicily (Palermo, Castelbuono). According to informa-

(1) See No. 605 of this Review. (Ed.)



tion received by the author, I. UGIONI found it in 1913 in the Valtournanche valleys and SILVESTRI at Acerra (Caserta) and Lower Nocera (Salerno), where it did great damage to dwarf beans. In Tuscany the weevil is well known in the provinces of Florence, Leghorn, Lucca and Pisa, and the other provinces are not free. The large province of Pisa is particularly badly infested.

In the larval stage the insects prefer the seed of the numerous varieties of dwarf bean (*Phaseolus vulgaris*), and scarlet runner (*Ph. multiflorus*). In Tuscany the larger white varieties suffer most ("fagioli pisani", or "fagioli di S. Michele" or "premi") as well as elongated beans ("pinoli" or "piroli"); but the small varieties ("tondini") are less attacked.

In the absence of dwarf beans, however, the weevil may attack cow-pea (*Dolichos melanophthalmus*), bean (*Vicia Faba*), common vetch (*Vicia sativa*), white lupin (*Lupinus albus*), chickling-vetch (*Lathyrus sativus*), and garden pea (*Pisum sativum*). The author observed in artificial breeding that in exceptional cases the insect will adapt itself to maize.

A single bean seed may be attacked by 25 larvae in one generation, and the generations succeed each other very rapidly. The cotyledons become a mass of debris of no value as food. Even when infestation is slight the beans suffer heavily. It frequently happens that the beans cannot be sold and have to be thrown away or given to animals. In the province of Pisa and other districts the damage has been so heavy that some farmers have had to give up growing dwarf beans.

From a point of view of reproduction even, beans attacked by the weevil cannot be used as seed. An experiment carried out by the author in the spring of 1917 with dwarf beans gave the following results:—

Condition of dwarf beans		Number of beans sown	Number of beans germinated	Percentage of germination
Not attacked by		50	42	84 %
	1 generation . . . . .	50	22	44 "
	2 generations . . . . .	50	24	48 "
	3 " . . . . .	50	10	20 "
	4 " . . . . .	50	3	6 "
	5 " . . . . .	50	0	0 "
Percentage of unattacked beans which germinated . . . . .				84 %
Percentage of beans attacked by the weevil which germinated . . .				23.6 %
Percentage of beans attacked by the weevil which were destroyed .				76.4 %

Moreover, plants from seed attacked by the insect are much less resistant and subject to disease, besides giving a much lower yield of inferior quality.

*A. obtectus* has an efficacious enemy in the mite *Pediculoides ventricosus* (Newp.), but, to the author's knowledge, it has in Italy no natural enemy among the insects. The mite mostly attacks the newly-hatched

larvae, but may also attack adult larvae and pupae, although their surroundings make this more difficult. The eggs themselves are sought for by the mite, which eats their contents. It must, however, be pointed out that if the action of this *Pediculoides* is really useful, it may, during the transport and handling of infested seed, attach itself to the skin of those who manipulate the beans and cause more or less serious pathological troubles.

The artificial method of control most widely recommended in America is based on the use of bisulphide of carbon fumigations when the adults of the first and second generations appear, in the same manner and proportions as those required for wheat or other cereals. Another method, which the author found much more preferable for dwarf beans grown for food, is to put the beans attacked in an oven or drying room at a temperature of about 60°C.

607 - *Hypothenemus ritchiei* n. sp., a New Scolytid Injurious to Dried Sweet Potatoes in Jamaica. — SAMPSON, WINN, in the *Bulletin of Entomological Research*, Vol. VIII, Pt. 3-4, p. 295. London, February, 1918.

The paper gives a morphological description of the scolytid *Hypothenemus ritchiei* n. sp., found by Mr. A. H. RITCHIE, Government Entomologist for Jamaica.

The beetle causes serious damage to dried sweet potato chips. It is not yet known whether it attacks other products.

608 - A New Weevil Pest of Sweet Potatoes in Jamaica. — MARSHALL, GUY, A. K., in the *Bulletin of Entomological Research*, Vol. VIII, Pt. 3-4, pp. 269-272 + 1 Fig. London, February, 1918.

The Imperial Bureau of Entomology recently received from Mr. A. H. RITCHIE, Government Entomologist in Jamaica, specimens of a weevil which had caused serious injury to tubers of sweet potato. The insect, which belongs to the sub-family *Cryptorhynchinae* is a species new to science and is described under the name of *Palaeopus costicollis*.

According to Mr. RITCHIE the damage done by this weevil to sweet potatoes is similar to that done by *Euscepes batatae* Waterh., common in the West Indies and known there as "scarabee". As these two insects may easily be confused by untrained observers, Mr. RITCHIE considers it very probable that damage attributed to *E. batatae* has been caused by *P. costicollis*.

The author found in the British Museum two other specimens of the genus *Palaeopus*, one from St. Vincent and the other from Grenada. They are specifically distinct from the Jamaican species and from each other, and, as their habits are probably similar to those of *P. costicollis*, the author describes them in his paper under the names of *P. grenadensis* n. sp. (weevil from Grenada), and *P. subgranulatus* n. sp. (weevil from St. Vincent).

609 - Insect Parasites of the Cacao Tree and other Cultivated Plants in São Thomé. — DE SCABRA, A. F., in *Mémoires publiés par la Société portugaise des Sciences naturelles*, Vol. III, Pt. 1, pp. 1-28 + 24 Figs. + 1 Plate. Lisbon, 1917.

With the help of material obtained from various parts of São Thomé the author has collected in his paper a series of observations on the insect

parasites of cultivated plants in the island. The study pays particular attention to scale insects.

I. — A morphological description is given of a coccid which, with due reservation, the author identifies as *Aspidiotus trilobitiformis* Green. This species shows preference for cacao leaves, and is found ranged with great regularity along the main veins; the females are relatively rare on the upper surface, whereas, on the lower surface, the males are very rare.

According to information supplied by the director of the Perserverança farm, the damage caused by the insect is of less importance than that caused by certain cryptogamic diseases. The effect is first seen at the ends of the branches, which gradually dry up, so that, in two or three months, the plant loses all its leaves. Sometimes cutting the branches attacked prevents the development of the parasite, but this is not always the case and infestation spreads with great rapidity. The cut branches should be destroyed immediately near the tree.

The bailif of the Bindá farm states that trees from four to six years old suffer most. The attacks of the coccid assume great importance on the Uba Budo farm; production there is almost nil.

Spraying with petroleum emulsion and other insecticides has been attempted, but its practical use is very difficult on account of the thick vegetation of the island which sometimes makes access to the plants impossible. Good results are hoped for from the propagation of fungoid parasites of the scale; experiments on this subject have already been made.

II. — The coccid *Lecanium viride* has been reported in the island, from specimens received from Peserverança farm, as a serious parasite of coffee; it is accompanied by its greatest natural enemy, *Cephalosporium Lecanii* Zimm. As this latter is fairly common in São Thomé, the author believes that, considering the very favourable climate, it would be easy to propagate it on a large scale. Experiments in the cultivation of this fungus have already been made in the island. The presence of this *Cephalosporium* may explain why a coffee plantation on the Perseverança farm which was severely attacked by the coccid in October, 1916, did not suffer serious damage. The fungus may be best disseminated by the method used in Ceylon, by which leaves bearing coccids attacked by the parasite are introduced into the plantations where *Cephalosporium* is non-existent or very rare; these leaves may be pinned on to those of plants to be protected against the attacks of the insect.

III. — A third note is confined to *Aspidiotus articulatus* Morgan and *Asp. palmarum* Morgan and Cockerell, neither of which occur in large numbers in the island but live at the expense of many wild and cultivated plants (coffee, *Ficus* sp.?, *Carica Papaya*). One of the wild plants particularly attacked by *Asp. articulatus* is an orchid, locally called "herba pega pega", which has been identified as *Megaclinium falcatum*.

*Asp. palmarum* is very abundant on the Uba Budo and Perseverança farms on *C. Papaya* and on *Ficus* sp.?. It is also found on many other native plants, but rarely on the cacao tree.

IV. — *Lecanium nigrum* Nictner is another parasite of coffee in the island, and is also very common on the large leaves of *Ficus* sp.? (Perceverança farm). The young larvae in particular are attacked by a fungus. The dimensions, shape and colour of this species vary; on the leaves attacked by it the author found a large number of specimens of *Asp. trilobiformis* and *Diaspis* sp.

V. — Among the most abundant parasites of coffee at São Thomé is the coccid *Orthezia insignis* (Douglas), which also attacks other plants. The author received from the Perceverança farm leaves completely covered with this insect which, according to the reports received, attacks in a general way the young buds, branches and stem, but seems to prefer the terminal bud of the plant. The coccid is found both on the upper and lower side of the leaf; sometimes it is found round the edge of the leaf. The branches attacked by the scale which were sent to the author for examination were found to be almost covered with a fungus (*Capnodium Coffeae* ?) the importance of which in São Thomé may be compared with that of *Capn. Citri* in Europe; the damage done when it attacks the young buds is well known. *O. insignis*, then, is a parasite dangerous, not only on account of the damage it does itself, but also because its secretions may form a favourable medium for the development of the fungus.

VI. — White ants are considered very injurious, especially in old cacao plantations. In a climate such as that of the island consideration must be given not only to the consequences to the plant itself of the galleries made by the ants, but also to the fact that the open galleries in the trunks, roots, or even the soil, prepare the way for numerous cryptogamic diseases.

Through the research of Prof. E. SILVESTRI six species of white ants are known in São Thomé, and seven in Princes' Island. The first specimens sent from São Thomé and examined by the author belonged to *Neoterme gestri* F. Silvestri, known locally as "Salalé"; numerous specimens of this species were sent from Binda in June, 1916. Another variety from the same locality, of which only very few specimens were received belonged to the s. sp. *theobromae* Dens. of *Microcerotermes parvus* Hav. It is known in the island by the name of "formiga branca". *N. gestri* is one of the greatest pests of the cacao plantations at Uba Budo. The infested plants are said to revive if cut at the base so long as they are not attacked by disease. At S. João dos Angolares, *N. gestri* also attacks old plantations, entering the trunks by badly closed pruning cuts.

In August, 1916, the author received the first notice of damage done by *N. gestris* as being of great importance in the occurrence of cryptogamic diseases. The old plants suffered most, especially those with broken branches which had not been carefully treated with protective substances. According to the author the insect always enters the trunks in the upper part, but the nests are always underground. The bailif of the Binda farm also observed that the insect enters the trunk in the upper part and shows a tendency to descend, never to ascend the branches. This observation may be of value in controlling the pest.

610 — **The Most Common Deformities Caused by Animals on Fruit Trees in Sicily.** — DE-STEFANI, T., in *Annali della R. Stazione di Agrumicoltura e Frutticoltura, Acireale*, Vol. IV, pp. 147-170 + 1 Plate. Acireale, 1917.

The aim of the paper under review is to draw attention to the numerous and complex deformities of animal origin of which horticulturists ignore the cause. Insects and other invertebrates (arachnida, worms) are the causes of these deformities. They belong chiefly to the hemiptera, and, more especially, to the aphids, and, in decreasing order of importance, to the diptera, with the family of *Cecidomyiidae*, the lepidoptera, with 4 representatives, the coleoptera, with 2, the hymenoptera and neuroptera, with only one representative. The greater part of the species causing deformities on fruit trees, however, belong to the arachnida, especially the mites, which form the family of *Eriophyidae* and certain species of nematodes, belonging to the family of anguillulidae.

In order to draw up a guide by which tree growers may recognise deformities caused by animals, the author gives a brief morphological descriptions of such injuries most common in Sicily, together with an indication of the specific agent.

611 — ***Olethreutes variegana*, a Microlepidopteron Injurious to Fruit Trees, in Italy.** — SARRA, A., in the *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 175-187. Portici, 1918.

The species described exists in central and southern Europe, Livonia, Finland, Sweden, and Asia Minor. A morphological description is given of the egg, larva, and pupa, followed by the biology of the perfect insect and the larva.

In the districts of Santeramo Colle (Apulia) and Matera (Basilicata), the larva lives on the common medlar, almond, mahaleb cherry, plum, apricot, and apple trees. The author found it from March 15 to April 30. Medlar and plum trees are attacked the most. Other host-plants are: *Prunus avium* L., *P. Cerasus* L., *P. insititia* L., *Pyrus communis* L.

The parts of the medlar which suffer most are the leaves, the floral buds, and the small fruit, which is covered with holes or entirely destroyed. On the plum, apple, apricot and mahaleb cherry trees, only the leaves are attacked. The leaves of the almond are attacked, and sometimes, though rarely, the young fruit, which is pierced and filled with the remains of the seed involucre. Experiments have shown that a larva fed on almond leaves will eat almost two whole ones in three days so that it may do a fair amount of damage to a medium sized tree. In the company of other tortricids, however, and especially if low trees, such as the medlar, are attacked, the injury done by *O. variegana* may be very serious.

According to the author the insect is controlled by five parasitic hymenoptera — the chalcid *Copidosoma* sp., the braconid *Accogaster quadridentatus* Wesm., *Apanteles longicaudis* Wesm., *Macrocentrus thoracicus* Nees, and the ichneumonid *Pristomerus vulnerator* (Pauz.) Curtis.

The chalcidid lays an egg in that of *O. variegana*; the author noticed that 4 % of the larvae of the microlepidopteron contained parasites.

*A. quadridentatus* lays its egg in the larva of the tortricid, and was found in 20 % of them. *Ap. longicaudis* also lays an egg in the larva of *O. varie-*

*gana*, being found in 6 %. The larva of *M. thoracicus* is an endophagous parasite of the larva of the microlepidopteron; the specimens of the braconid examined by the author represented 1 % of the larvae of *O. variegana*. *Pr. vulnerator*, the larva of which is also an endophagous parasite of that of the tortricid, was observed in 4 % of the latter.

When it is easy to collect the larvae the natural method of controlling *O. variegana* is to be recommended, and should be carried out in April. The larvae are enclosed and bred in boxes placed in the open, and covered with a wire netting with a mesh not exceeding 2 mm., so that the parasites may pass, but not the adult microlepidoptera. When artificial control is necessary spraying with 1 % lead arsenate paste or ½ % lead arsenate powder may be recommended.

612 — **The Campaign against the Codlin Moth (*Carpocapsa pomonella*) in Cyprus, in 1917.**— *The Cyprus Agricultural Journal*, Vol. XIII, Pt. 1, p. 13. Nicosia, 1918.

In accordance with His Excellency's Order of April 25, 1917, a campaign was started in 1917 in Cyprus, against the codlin moth, which, for some time, had caused much injury to apple, pear, quince and walnut trees. The area of operations included some 26 villages in the Pitsillia of which Agros was the centre.

The treatments applied were:— a) lime-dressing; b) daily collection and destruction of fallen fruit; c) bandaging the trunks with grass or cloth bands.

The application of grass bands was not very successful. As many as 80 000 trees were lime dressed.

613 — **Strong Lime-Sulphur Spraying against *Chrysomphalus dictyospermi*, a Coccid Injurious to Citrus.**— SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura in Acireale*, Bollettino No. 30, pp. 3. Acireale, 1917.

Without modifying in any way the formula of the lime-sulphur mixture used by the "R. Stazione di Agrumicoltura e Frutticoltura" of Acireale (lime, 2 lb.; sulphur, 4 lb.; water, 2 gall.) attempts were made to ascertain whether it were possible to increase the insecticidal power of the dilute mixture, i. e., the percentage, in order to obtain a greater and more rapid effect against the scale *Chrysomphalus dictyospermi* ("bianca-rossa" of citrus).

The results obtained from the various experiments carried out under the supervision of the author may be summarised as follows:—

- 1) The trees may be sprayed in September and at the beginning of October with a 10 % mixture, density 1.25, to obtain better results;
- 2) 10 % must not be exceeded as the plant may be scorched;
- 3) the spraying must be even and very fine but not very abundant, as, if so, even in percentages below 10, it may cause scorching;
- 4) the percentage may be raised to 12 % when the *Chrysomphalus* attack is severe, and when the fruits are few, completely infected, and valueless.

Strong treatment is advantageous in the case of bad attacks or when spraying at the correct time has been neglected. Orange trees — the fruit of which would lose all value if scorched — should, however, only be treated if infection is so serious that it is the tree itself which must be saved. As a general rule it may be said that only lemon trees should be so

treated ; the fruit which is thrown out might be used for obtaining essence or citrate, as lemons when slightly scorched are in no way spoilt for the extraction of these two products.

614 — Observations on *Coeliodes ruber*, a Coleopteron Injurious to Hazel Trees in Italy. — SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e agraria della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 155-174 + 14 Figs. Portici, 1917.

Before 1904 the damage done to hazel trees by the coleopteron *Coeliodes ruber* (Marsh) had not been studied. In that year TROTTER drew attention to the injury done to the male inflorescences of the tree by the larvae of this insect. The question was not taken up again till 1914, when great loss of nuts was reported at Vico di Palma, Campania (province of Caserta) though the attacks of *C. ruber*. The author, therefore, undertook a study of the insect, and, during the last three years, continued his studies not only in the Nola district, but also in the Avellino district.

After giving a detailed morphological and biological description of the insect the author points out that *C. ruber*, which is only known to attack hazel trees, is shown by the catalogues of coleoptera to exist throughout Europe. In Italy the author found it frequently in the districts of Avellino and Nola, as well as round Naples, he has also seen specimens from Capri and found a few in Sicily (S. Piero Patti).

The adults attack the leaves, piercing holes in the blade or in the petiole. They also attack the buds by hollowing a hole in the axis, a few centimetres from the point, the nuts, by piercing the shell and part of the kernel, which they eat, the catkins, by piercing them and eating some of the flowers ; they may also attack the floral and leaf buds. The attacks result in the drying up of the pierced leaves, buds and young nuts, and the destruction of some of the flowers of the catkin. The larvae also destroy some of the male flowers.

The most serious damage caused by the adults and larvae would appear to be that done to the petiole and the axis of the buds. In reality, however, if this damage is compared with the number of insects found in three years and the number of leaves and buds on a plant, it may be considered negligible. This also applies to the damage to the catkin, for, since the catkin is not entirely destroyed, there remains a plentiful supply of pollen. If, contrary to the author's observation, the greater part of the catkins were destroyed, atrophy of the female flowers through lack of fertilisation, such as TROTTER feared, might be expected.

The worst damage by *C. ruber* observed by the author and complained of by growers from 1914 to 1917, is that done to the young nuts which, if pierced by the insect once only, immediately dry up. Such injury has been frequently observed in the Nola district, where the S. Giovanni, an early variety, the fruit of which, at the end of May, is already 5 mm. long and 7 mm. broad is the most common variety of hazel.

In field observations the author frequently saw spiders of the family *Thomisidae*, *Xisticus lanio* C. Koch, capture adult *Coeliodes* for food. Others also probably attack the insect, but, judging by the number of *C. ruber* on the trees, their action does not appear to be very efficacious.

From 1914 to 1917 the author observed numerous eggs, larvae and

pupae of *C. ruber*, but only noticed one parasitic hymenopteron (fam. *Ichneumonidae*) which laid its eggs in the larvae which was later eaten by the insect hatched from the egg while it was underground in the cell in which its metamorphosis should have taken place. The author calls the new hymenopteron *Thersilochus coeliodicola*.

The only efficacious and practical artificial method of control is the collection of the adult insects during the first fortnight in May. This should be done in the morning by means of a cloth stretched under the plant, the branches of which are shaken by hand or with hooked sticks. By this means are destroyed at the same time many nut weevils (*Balaninus nucum* [L.]), another curculionid which occurs on hazel trees at the same period and often does great damage by attacking the nuts. If *C. ruber* is not collected in May it should be collected at the end of September or the beginning of October.

615—*Coleophora fuscadinella*, a Microlepidopteron Injurious to Birch and other Trees in Sweden. — KEMMER, N. A., in *Kungl. Landbruks Akademien Handlingar och Tidskrift*, Year LVII, No. 7-8, pp. 637-660 + 30 Figs. + Bibliography of 15 Publications. Stockholm, 1917.

In 1914 the conditions in Sweden were very favourable to the development of *Coleophora fuscadinella* Zell. ("Björksäckmalen") the numerous larvae of which, in 1915 and 1916, caused considerable damage to birch trees by attacking their foliage. Other trees besides birch were attacked — pear trees, apple trees, *Sorbus Aucuparia*, oaks, etc. — with such violence that at times the whole tree, or a greater part of it, dried up.

The districts which suffered most were those of Östergötland, Jonköping, Kronoberg, and Kalmar, whereas in the Malmöhus district the attacks were very limited, probably because there are few birch trees there. More or less wide-spread attacks were also reported from the districts of Älfsborg (Vänersborg), Örebro (Bofors), Sörmlands (Stenstorp), Kopparberg (Falun), and Norrbotten (Luleå). Copulation and oviposition occur towards the end of June and the beginning of July. The larvae hatch after about a fortnight and live on the leaves, eating the tissues. They hibernate on the branches of the host (near the buds) in a shelter made of bits of leaf joined by silky threads. Hibernation ends in May, and it is in this month and in June that the adult larva, before pupating, does the greatest damage.

In 1917 the pest was decreasing rapidly, certainly largely on account of the many natural enemies of the insect which have been reported in various parts of Sweden. Amongst them are:—*Hemiteles* sp. ♂; *Itoplectis maculator* F. ♂ and ♀; *Glypta* sp. ♂; *Phobocampa* sp. ♂; *Agathis varipes* Th.; *Apanteles sodalis* (?) Hall.; *Apanteles* sp.; *Pezomachus instabilis* Först.; *Angitia* sp.; *Apanteles corvinus* Reinh.; *A. xanthostigmus* Hal.; *A. mesoxanthus* Ruschka n. sp.; *Microdus mediator* Nees; *Habrocytus radialis* Thoms.; *Dibrachys boncheanus* Ratz.; *Elasmus viridiceps* Th.; *Cirrospilus pictus* Nees; *Miotropis sulcicrista* Th.; *Chrysocharis elongata* Th.; *Geniocercus charoba* (Walk). Kurdjium.

*A. mesoxanthus* n. sp. was reported from Lamhult (Kronoberg) and from Luleå.

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ALFREDO RÜGGERI, gerente responsabile.



INTERNATIONAL INSTITUTE OF AGRICULTURE  
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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

616 - The Nutritive Value of Yeast, Polished Rice and White Bread as Determined by Experiments on Man. — FUNK, CASIMIR, LYLE W. G. and MC CASKEY, DONALD, in cooperation with CASPE, JOSEPH and POKLOP, JOSEPH, in *The Journal of Biological Chemistry*. Vol. XXVII, No. 1, pp. 173-191, Bibliography of 23 publications, Baltimore, Md., 1916.

RURAL  
HYGIENE

Concerning the problem of a protein minimum, there are two distinct theories: ABDERHALDEN and his school claim that, as the composition of the body, and especially of the blood proteins, is so different from food proteins, the best protein minimum can be obtained by feeding proteins of the same species; on the contrary, HINDHEDE was able to show that, when using potatoes as practically the only food, 1 gm. of the absorbed potato nitrogen is equivalent to 1 gm. of body nitrogen. One cause of discrepancy of opinion on this question is that the importance of vitamins in metabolism has been overlooked in most recent experiments. There must be a fixed ratio between the vitamine content and the carbohydrate: if this ratio is destroyed, disordered nutrition of the tissue cell occurs (1).

Considering that heretofore the vitamins in foods have been disregarded in all nutrition experiments on man, the writers have performed on four normal men the experiments here described, in order to determine primarily the food value of a vitamine-free diet as compared with one containing vitamins. The results are summarized as follows:—

Yeast cannot very well be recommended as a sole protein source, as a large part of the yeast nitrogen apparently has no food value. It is badly assimilated and occasions a rise of uric acid figures in the blood. The

(1) In a recent paper of ABDERHALDEN, FODOR and RÖSE (*Archiv gesammter Physiologie* Vol. CLX, p. 511, 1915) we find a comparative study of the food value of potatoes as compared with whole bread and white bread. The protein minimum was lowest in the case of potatoes (4.5 gm. nitrogen), higher with whole meal bread (7.6 gm. nitrogen), and still higher with white bread (9 gm. nitrogen). a possible reason being that the white bread was deficient in vitamins.

amount of nitrogen which would be fully adequate in the form of potatoes was proved to be insufficient with yeast. This also applies to the experiments with white bread and white rice. The writers were unable to get a positive nitrogen balance by the addition of vitamine.

In this field of nutrition research the authors' studies have by no means enabled them to pronounce a verdict that yeast possesses no value in dietetics.

Problems of personal idiosyncrasy as to the taste of foods, methods of administration suitable for the particular individual, questions of amino-acid synthesis after the yeast protein and purine bases have entered the organism, are all complex factors which must be taken into consideration.

**617 - The Digestion of Aleurone Cells Incorporated in 85 % Bread; Experiments Made in France.** — LAPICQUE, L. and LEGENDRE, A., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 5, pp. 217-220. Paris, March 9, 1918.

The envelope which encloses the wheat seed, the fragments of which, more or less mixed with flour form the bran, contains on its inner surface the layer of aleurone cells. The authors' experiments confirm the fact, shown first by POGGIALE, then by AIMÉ GIRARD that the eminently digestible and nutritive contents of these cells are protected from the action of the digestive ferments by the cellulose walls. The authors found aleurone cells in the faeces of men and dogs after the ingestion of wheat which had been roughly ground, chopped, or rolled after having been softened by soaking. The authors believe this fact should be extended to certain herbivorous animals, as it was also observed in the guinea-pig and rabbit.

This resistance to digestive ferments is, however, clearly connected with the integrity of the walls. Baking does not affect the result, but, nevertheless, by rupturing the walls mechanically it is possible to render the nutritive substances accessible to the action of the digestive juices. In bran of the first milling which does not pass a No. 70 sieve, the walls of the layer of aleurone cells are intact, and the aleurone thus resists baking and digestion. If, however, the bran is re-milled so that most of it passes through a No. 100 sieve, the walls of the aleurone cells retained by a No. 200 sieve are still intact, but nearly all of these break during baking, and, after digestion, only the empty walls are found in the faeces, the contents having been digested, as the authors proved experimentally. It is for this reason that in bread made with 85 % flour, the bran of which is mixed with fine flour and re-milled (as decreed in France at the present time) without any systematic preparation, the greater part of the aleurone cells is digested, thus increasing the total food value of the bread by 1 to 2 %.

**618 - Physiological and Pharmacological Studies on Coal Tar Colours. Experiments with Fat-Soluble Dyes.** — SALANT, WILLIAM and BENGIS, ROBERT (Pharmacological Laboratory of the Bureau of Chemistry, U. S. Department of Agriculture, Washington), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 2, pp. 403-427, Bibliography of 20 publications. Baltimore, Md., 1916.

Although synthetic dyes have played an important part in the study of biology and medicine, the behaviour of many of these compounds in the body is still imperfectly understood and the action of some of them is

entirely unknown. Owing to their extensive employment in numerous industries, and especially in the preparation of foods, this lack of satisfactory information frequently proved to be a matter of serious import as questions regarding their effect on health were often raised, but no definite answer could be given in the present state of our knowledge.

The recognition of the need of a more intimate acquaintance with the reactions produced in the body by these compounds formed the starting point of these investigations.

The present report embraces the results of experiments with fat-soluble dyes. The following compounds were employed, the commercial names most commonly used and their numbers in SCHULTZ's tables are given at the right: —

Benzeneazo- $\beta$ -naphthyl-amine . . . . .	Yellow A. B. **	Benzeneazodimethylaniline Butter Yellow 32*
Tolueneazo- $\beta$ -naphthyl-amine . . . . .	Yellow O.B. **	Benzeneazophenol . . . . Oil Yellow
Benzeneazobenzeneazo- $\beta$ -naphthol . . . . .	Sudan III 223*	Benzeneazoresorcinol . . . Sudan G. 351*
Benzeneazo- $\beta$ -naphthol . . . . .	Sudan I 36*	Aminoazobenzene . . . . Spirit Yellow 31*

\* SCHULTZ, *Farbstofftabellen*, Berlin, 1914.

\*\* HELLER and MERTZ

Rabbits were mainly used as subjects of the experiments, but observations with some dyes were also made on a few cats and on rats. The results are summarized as follows:—

Oil-soluble and water-insoluble dyes administered to different animals were eliminated in the urine and in the bile. Elimination in the urine was usually inhibited in poisoning with zinc or oil of chenopodium.

Two of the compounds of benzeneazophenol and benzeneazoresorcinol, which were isolated from the urine of rabbits, proved to be conjugated with glucuronic acid.

Most of the dyes were deposited in the adipose tissues; staining of the nervous tissue, the kidney, and muscle was also observed in some experiments.

Ten to 15 hours after intravenous injection of 25 mgm. per kilo of benzeneazoresorcinol, the dye was still present in the blood.

The toxicity of the different dyes was not pronounced even when larger doses were administered.

619—Copper in Certain White Wines, in Chocolate and in Beans. — See No. 685 of this Review.

620 — Report on the Agricultural Control Stations of Holland for the Year 1916-1917.

— Communication from the Dutch Minister for Agriculture, in *Verslagen en Mededeelingen van de Directie van den Landbouw*, 1917, No. 4, pp. 88 + Tables. The Hague, 1917.

By Royal Decree of September 6, 1915, the Royal Agricultural Stations of Holland ("Rykslandbouwproefstations") were divided into 2 classes: experiment stations and control stations. The experiment stations are at Groningen and Hoorn; their reports are published regularly under the title

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK.

of "*Verlagen der landbouwkundige onderzoekingen van de Rykslandbouw-proefstations*". The bulletin under review contains the reports, for the year 1916-1917, of the following control stations: — *Wageningen*, control of live stock feeding stuffs; *Maastricht*, control of manures; *Goes*, control of remedies against fungi, etc.; *Wageningen*, seed control.

**WAGENINGEN STATION FOR THE CONTROL OF FEEDING STUFFS.** — From June 1, 1916 to June 1, 1917, 2467 samples were controlled by making 9895 analyses. The report of this station records a certain number of cases of falsification, chiefly with regard to compound or concentrated food stuffs, the majority of which are made up of products of absolutely no feeding value for live stock, but which are nevertheless sold at excessive prices; this is why, whenever it is possible to obtain simple feeding stuffs, their purchase should be advised in preference to that of any compound feed.

**MAASTRICHT CONTROL STATION.** — From June 1, 1916 to June 1, 1917, 10027 samples of manures were controlled, 15983 analyses being made. As with the preceding station, numerous cases of falsification were detected; this station also advises farmers who wish to buy artificial manures, in spite of the high price, to require that the nitrogen should be present in either ammoniacal or nitric form and that the phosphoric acid and potassium should be water soluble. On account of the lack of homogeneity of large stocks of fertiliser the station advises the taking of several samples and it distributes a circular free of charge showing how the samples are best taken.

**GOES CONTROL STATION.** — From October 1, 1916 to June 1, 1917, 2079 samples were examined, including 86 anticyptogamic substances and remedies against parasites, 1468 agricultural products, 243 soil and 58 water samples, 129 dairy products and 32 miscellaneous samples.

**WAGENINGEN SEED CONTROL STATION.** — From June 1, 1916 to June 1, 1917, 3783 samples were controlled, thus giving an increase of 35% on the previous year's number. Owing to present conditions, the quality of the seeds was very variable. Regional agricultural committees usually judge crops on the spot, calling "seed suitable for sowing" ("voor den zaai geschikt zaad") those that fulfil the required conditions and are suitable for cultivation; those judged in this way by the official district agricultural agent or a representative chosen by him are called "first quality seeds". Judging on the spot is too uncertain and can only give doubtful results; for this reason it is now well understood that accurate and rigorous control is more than ever necessary at the present moment.

## CROPS AND CULTIVATION.

### AGRICULTURAL METEOROLOGY

621 — **Method for Calculating the Length of the Growing Season at any Period of the Year and in any Locality.** — REED, G. W., in the *Monthly Weather Review*, Vol. XLIV, No. 9, pp 509-512. Washington, 1916.

To calculate the length of the growing season, it is customary to count the number of days elapsed between the average date of the last destructive spring frost and that of the first killing autumn frost, but, in accepting these average dates as they are the agriculturist would run great risk.

To shed light on the question, the data may be examined that have been collected at the Keokuk Station (Iowa, U. S. A.) where it was found that the average date of the last killing spring frost was April 15, that of the first killing autumn frost was October 15, while the average length of the season without frosts (growing season) was 183 days.

On analysing the statistics collected annually from 1872 to 1914, it will be noted that, out of 43 years, 20 had spring frosts after April 15, so that the degree of safety with regard to frost would be only 53 % in relation to the average date. On the other hand the statistics for the whole of the United States tend in general to confirm the fact that crops suffer from spring frosts every two years (50 % security) and at a date after the average one of the last killing frost.

As for killing autumn frosts, they appeared in 21 years out of 43 before October 15, so that the degree of security, in relation to the average date, varies round 50 %.

Out of the 20 years without killing spring frosts after April 15, there were 8 with autumn frosts before October 15, so that only 12 years of the entire period, or 28 %, really had 183 days without killing frosts, counting from the average date of the last killing spring frost.

To avoid risk of frosts, the farmer should sow or plant at a date sufficiently late so as to be sufficiently safe from spring frosts, but not so late as to prevent ripening before there is risk of autumn frosts. Thus, as has been already seen, the knowledge of the average length of the frostless season alone does not suffice, nor does it correspond to the desired aim.

The article under consideration gives data from which can be calculated the probably available growing season (*i. e.* without frosts) includey between a spring period and an autumn period where the degree of security from frosts is very high, in order to forecast a good harvest. The symbols used are as follows:—

$s$  = date of the last killing spring frost in any one of the years under consideration.

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$l$  = number of days elapsed between  $s$  and  $a$ .

$A_s$  = average date of the last spring frost.

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$A_l$  = average number of frost-free days

$A'_p$  = an arbitrary number near to  $A_p$ ;  $d_s$  = difference between  $s$  and  $A'_s$ .

$A'_a$  = an arbitrary number near to  $A_a$ ;  $d_a$  = difference between  $a$  and  $A'_a$ .

$A'_l$  = an arbitrary number near to  $A_l$ ;  $d_l$  = difference between  $l$  and  $A'_l$ .

$n$  = number of days of observation.

$\sigma_s, \sigma_a, \sigma_l$  = average differences from  $s, a$ , and  $l$ .

$\Sigma d_s, \Sigma d_a, \Sigma d_l, \Sigma d_s^2, \Sigma d_a^2, \Sigma d_l^2$  = algebraic sums of  $d_s, d_a, d_l, d_s^2, d_a^2, d_l^2$ .

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$n$  = number of days of observation.

$\sigma_p \sigma_a \sigma_l$  = average differences from  $s$ ,  $a$ , and  $l$ .

$\Sigma d_s, \Sigma d_a, \Sigma d_l, \Sigma d_s^2, \Sigma d_a^2, \Sigma d_l^2$  = algebraic sums of  $d_s, d_a, d_l, d_s^2, d_a^2, d_l^2$ .

In Table I are reproduced figures, quoted from those obtained at Keokuk for the first and last quinquennial periods of 1872 to 1914.

TABLE I. — *Data on Spring and Autumn Frosts at Keokuk*

Year	Last spring frost			Last autumn frost			$d_s, d_a$	Frostless season		
	$s$	$d_s$	$d_s^2$	$a$	$d_a$	$d_a^2$		$l$	$d_l$	$d_l^2$
1872 . . . .	April 16	+ 1	1	October 6	— 9	81	— 9	173	— 10	100
1873 . . . .	" 25	+ 10	100	" 6	— 9	81	— 90	164	— 19	361
1874 . . . .	" 23	+ 8	64	" 23	+ 8	64	+ 64	183	0	—
1875 . . . .	May 2	+ 17	289	September 18	— 27	729	— 459	139	— 44	1 936
1876 . . . .	April 2	— 13	169	October 7	— 8	64	+ 104	188	+ 55	25
. . . . .										
1910 . . . .	April 25	+ 10	100	October 22	+ 7	49	+ 70	180	— 3	9
1911 . . . .	" 9	— 6	36	" 22	+ 7	49	— 42	196	+ 13	169
1912 . . . .	" 3	— 12	144	" 23	+ 8	64	— 96	203	+ 20	400
1913 . . . .	" 13	— 2	4	September 22	— 23	529	+ 46	162	— 21	441
1914 . . . .	" 10	— 3	9	October 27	+ 12	144	— 36	198	+ 15	225
Sums . . .	—	— 30	5 904	—	+ 5	— 6 487	— 1 111	—	+ 85	14 612
Means . . .	April 15	—	—	October 15	—	—	—	183	—	—

The formula :  $\sigma = \sqrt{\frac{\sum d^2}{n} - \left(\frac{\sum d}{n}\right)^2}$  is used for calculating the standard deviation  $\sigma$ . On substituting the values given in Table I for the symbols, we have, for  $\sigma_s$ ,  $\sigma_a$ , and  $\sigma_l$ :

$$\sigma_s = \sqrt{\frac{5904}{43} - 0.49} = 11.7 \text{ days}, \quad \sigma_a = \sqrt{\frac{6487}{43}}; \quad 0.01 = 12.3 \text{ days};$$

$$\sigma_l = \sqrt{\frac{14612}{43} - 0.66} = 18.4 \text{ days}.$$

Once the standard deviation is known, it is easy to find the probability of frost or the degree of safety for any time, by the aid of Table II, based on the theory of probabilities.

TABLE II. — *Determination of the dates corresponding to the various probabilities of frost and to the various degrees of security.*

Probability of frost	Degree of safety	Calculation of the dates	
		Spring	Autumn
50 %	50 %	$A_s$	$A_a$
40	60	$A_s + 0.25 \sigma_s$	$A_a - 0.25 \sigma_a$
30	70	$A_s + 0.52 \sigma_s$	$A_a - 0.52 \sigma_a$
25	75	$A_s + 0.67 \sigma_s$	$A_a - 0.67 \sigma_a$
20	80	$A_s + 0.84 \sigma_s$	$A_a - 0.84 \sigma_a$
10	90	$A_s + 1.28 \sigma_s$	$A_a - 1.28 \sigma_a$

Thus, multiplying 0.52 by 11.7 ( $\sigma_s$ ) and adding the product (nearly 6) to the date April 15 ( $A_s$ ), the date April 21 is obtained, when the probability [621]



of frost is reduced to 30 %, while it is 50 % on April 15. For the autumn a similar calculation is made, but the product obtained is *subtracted* from  $A_s$ .

The degree of safety for a given period as regards frost is obtained by multiplying the degree of safety for the beginning of the period by the degree of safety for the end of the period. Thus, for example, on April 15 and October 15 the degree of safety is 50 %; for the period April 15 - October 15 the degree of safety would be  $0.50 \times 0.50 = 0.25$ , or 25 %, *i. e.*, very close to the value obtained on counting the cases directly.

The agriculturist would run great risks, if he only based his calculations on the average length of the frost-free period. In fact, as is shown in Table II, the degree of 70 % of safety is obtained: in spring, 0.52  $\sigma_s$  days *after* the average date of the last killing frost; in autumn, 0.52  $\sigma_s$  days *before* the average date of the first killing frost — that is, April 21 and October 8 respectively. For the period of 170 days included between these two dates, the degree of security is about 50 % ( $0.70 \times 0.70 = 0.49 = 49$  %). The risk would still be great.

For a crop to succeed, there must be a degree of safety of at least 80 %, that is, there must be at least 4 good years out of 5. In this case, the degree of safety at the beginning and end of the frost-free period must be 90 % ( $0.90 \times 0.90 = 0.81 = 81$  %). In the case of Keokuk, by calculating the value of  $A_s + 1.28 \sigma_s$  and  $A_e - 1.28 \sigma_e$ , the two dates April 30 and October 1, are obtained which have the degree of 90 % safety; this means that, in that locality, the degree of safety is 90 % for the 153-day period included between April 30 and October 1; in other words, as far as risk of frosts is concerned, any crop may be sown and harvested successfully.

622 — **The Relation of Weather to the Amount of Cotton Ginned during Certain Phases of the Harvest.** — KINCER, J. B., in the *Monthly Weather Review*, Vol. XLV, No 1, pp. 6-10, 2 Figs. Washington, 1917.

During the cotton harvest, the U. S. Bureau of Census, Department of Commerce, issues periodical reports as to the cotton ginned during the following harvest periods:— September 1 and 25; October 18; November 1 and 14; December 1 and 13; January 1 and 16.

In order to resolve the question of the influence of weather on the amounts of cotton ginned during these periods, a series of researches was carried out in the cotton belt; the present article discusses the results thus obtained.

The growth of cotton has strictly geographical limitations, established largely by temperature conditions, as the plant requires a mean summer temperature of about 78° F and an average frostless season of about 200 days. The higher the temperature is during the active growing season, principally in May and June, the earlier will be maturity, and the bigger the crop.

For example, Table I gives the data obtained for the State of Oklahoma for the period 1905-1915, as regards the influence of temperature on yield. Column II shows the number of bales, of 500 lb. each, ginned up to October 18, to the nearest thousand bales; thus the first number, 179, shows that, out

of 1000 bales total yield, 179 were obtained up to October 18; this number is 112 less than the average 291. Column III shows the variations from the average. Columns IV, V, VI and VII show the variations from the normal temperature for the period May to August, while Column VIII shows the variations in temperature calculated for the whole period. Column III and Column VIII correspond almost perfectly; when the average temperature of the period May-August is below the normal, the cotton ginned during the first period of the harvest (up to October 18) is below the average and vice-versa.

TABLE I. — *Relations of the temperatures of the period May-August and the cotton ginned during the first period of the harvest in Oklahoma.*

I Years.	II Bales ginned up to October 18.	III Departure from average yield	Temperature departure from normal, in °F				VIII Average daily departure from the normal temperature, May-August in °F
			IV May	V June	VI July	VII August	
1905 . .	179	— 112	+ 0.2	+ 1.8	— 2.8	— 0.1	— 0.9
1906 . .	199	— 92	— 0.1	— 1.4	— 4.2	— 3.1	— 8.8
1907 . .	240	— 51	— 0.8	— 1.4	+ 0.2	+ 2.0	— 6.0
1908 . .	133	— 158	— 0.6	— 1.0	— 2.5	— 0.9	— 5.0
1909 . .	329	+ 38	+ 1.5	+ 0.9	+ 3.3	+ 3.3	+ 6.0
1910 . .	422	+ 131	— 2.2	+ 0.5	+ 2.7	+ 0.1	+ 1.1
1911 . .	397	+ 106	+ 4.0	+ 8.3	+ 0.3	— 0.6	+ 11.4
1912 . .	398	+ 107	+ 3.6	— 2.2	+ 2.9	— 1.2	+ 3.7
1913 . .	391	+ 100	+ 2.8	+ 0.2	+ 3.7	+ 4.8	+ 11.5
1914 . .	451	+ 160	— 0.6	+ 5.4	+ 4.6	— 1.0	+ 8.4
1915 . .	66	— 225	— 1.7	— 2.0	— 2.1	— 7.0	— 12.8
Mean	291						

Data are also given for the States of North Carolina, South Carolina, Georgia, Alabama, Mississippi, Texas and Arkansas.

In Oklahoma, close to the northern limit of cotton, all the negative oscillations, even in very advanced stages of development (July-August), have considerable influence on the plant, whose critical period for temperature covers the whole period May-August, whence the positive correlation between the figures of Columns III and VIII. But when going south, temperatures below the normal, especially in July and August, are always relatively high and cannot affect the normal growth of the cotton plant, so that the critical time for temperature tends to be limited to May and June. Thus, in Georgia, South Carolina and Alabama, the departures from the normal yield during the first period of the harvest correspond exactly to the departures from the normal temperature during the period May-June. On the contrary, the correlation is much less relatively to the whole period from May to August, on account of the great heat.

The increased maturity due to positive variations in temperature in

May and June is accompanied by an increased yield during the early part of the harvest and, on the contrary, by a decrease during the latter part. Table II gives the data for Georgia. In that State, to the south of Oklahoma, the harvest begins much earlier than in the latter State, the first period ending on September 1, instead of October 18. The variations in yield, which are usually positive and occur during the first and second periods of the harvest (up to September 25), correspond to positive variations in temperature, as do the variations, usually negative, during the following periods (after September 25), and vice-versa.

TABLE II. — *Departures from the average yield during various ginning periods ; average daily temperature departures from the normal during May and June in Alabama.*

Year	Departures from the average yield, in percentages ginned						Average daily departure from the normal temperature during May-June
	Up to September 1	From Sept. 1 to 25	From Sep. 25 to Oct. 18	From Oct. 18 to Nov. 1	From Nov. 1 to Nov. 14	From Nov. 14 to Oct. 1	
1914	+ 1.2	+ 2.1	- 6.4	- 0.5	+ 1.1	- 0.8	+ 3.5
1911	+ 1.0	+ 1.5	- 0.2	- 2.4	- 2.8	- 0.6	- 1.3
1905	+ 2.9	+ 6.8	- 1.2	- 1.3	- 2.1	- 1.9	- 3.9
1915	+ 3.1	+ 8.9	- 4.5	- 2.2	+ 0.9	- 2.1	- 0.4
1908	- 0.5	+ 1.6	+ 2.2	- 1.5	- 1.0	—	- 1.9
1906	- 2.3	- 5.4	- 2.5	+ 2.3	+ 1.7	+ 3.2	- 4.8
1913	- 0.7	- 5.3	+ 6.0	- 1.9	- 0.7	+ 1.5	+ 4.3
1912	- 1.9	- 8.0	+ 0.4	+ 2.5	+ 2.2	+ 3.9	- 1.6
1909	+ 1.9	+ 2.2	+ 2.8	- 0.4	- 0.5	- 2.8	- 1.3
1907	- 1.9	- 4.6	+ 0.4	+ 2.3	+ 0.1	- 1.9	+ 5.3
1910	- 2.7	- 2.0	+ 1.8	+ 3.0	+ 0.9	+ 1.5	+ 2.9

Another weather factor, of less importance than that of temperature, but worth consideration, is that of the number of fair days ; the more there are, other conditions being equal, the greater will be the yield during the corresponding periods. As regards this point, Table III gives the figures obtained in Alabama for the period from September 25 to October 18 ; it will be seen from the almost completely identical figures of columns II and IV, that the correlation between the two groups reaches the maximum ; the positive or negative departures in the number of clear days correspond to similar departures in the yield.

The planters and cotton brokers attach considerable importance to the reports of the Bureau of the Census regarding the amounts of cotton obtained in the first or first two periods of the harvest, as the value of cotton depends largely on the amount grown. A forecast of the size of the cotton crop, based on the ginning reports, has a much greater value when consideration is given to the influencing weather reports, as has been pointed out, than when the reports alone are considered.

TABLE III. — *Relation between the cotton ginned and the number of clear days for the period from September 25-October 18, in Alabama.*

I	II	III	IV	V
Year	Amount ginned in % of the total yield	Departure from average yield	Fair days, in percent of the total number of days	Departure percentages of clear days
1905. . . .	25.5	— 1.6	78 %	— 5
1906. . . .	19.9	— 7.2	65	— 18
1907. . . .	25.1	— 2.0	78	— 1
1908. . . .	28.4	+ 1.3	83	+ 8
1909. . . .	31.2	+ 4.1	87	+ 8
1910. . . .	27.2	+ 0.1	74	+ 12
1911. . . .	28.3	+ 1.2	82	+ 4
1912. . . .	30.1	+ 3.0	70	— 1
1913. . . .	34.6	+ 7.5	91	+ 8
1914. . . .	24.2	— 2.9	65	— 14
1915. . . .	23.9	— 3.2	70	— 3
<i>Means</i>	<b>27.1</b>	—	<b>77</b>	—

For example, if temperatures during the critical months of growth are high and the weather be favourable for picking during the first period, it may be taken that the yield during that period will be high, while the final yield will be much less than that apparently indicated by the actual amount ginned to that date.

On the other hand, if the temperature is low during the growing period (retarded maturity) while rainy days retard the harvest at the beginning, the yield of the first period will be low, but as the successive yields will be high, the total yield will be higher than that calculated on the basis of statistics for the first period.

Again, when the temperature is high during the growing period and there are rainy days at the beginning of harvest, or, on the contrary, if the temperature is low during the growing period, with clear days at harvest time, there will be, in these 2 cases, two groups of phenomena tending to neutralise each other and the statistics for the first crop will allow a forecast of the final yield to be made with greater accuracy without the need of making corrections for early or late maturity.

To obtain a good forecast of the final crop (total yield of all the periods of harvest), by using the meteorological and statistical data for a single period, the author proposes the use of the equation: —  $X = \frac{a}{bc}$  where  $X$  is the approximate total crop;  $a$ , the number of bales ginned during the period;  $b$ , the percentage of the total crop ginned on the average (for a series of years) for each fair day of the period; and  $c$ , the number of fair days during the particular period.

To gain an idea of the accuracy of the information obtained by using this formula, it will be seen from Table IV that the figures of columns VI and

VII closely approximate; the error being never greater than 5 %, and averaging about 2.5 per cent.

TABLE IV. = *Forecast of the total yield of ginned cotton in Georgia, based on statistics for the crop-period September 1 to November 14, using the formula  $X = \frac{a}{bc}$ .*

I	II	III	IV	V	VI	VII	VIII
Year	Percentage of total crop ginned during the period	(a) Number of fair days during the period	(bc) $b = \frac{II}{III} = 1.281$	(a) Number of bales ginned during the period	(x) Computed approximate crop $x = \frac{a}{bc}$	Actual crop	Percentages of computed error
1905 . . .	76.7 %	61 %	78.1	1 323	1 694	1 725	1.8 %
1906 . . .	71.6	56	71.7	1 118	1 629	1 633	0.2
1907 . . .	72.7	58	74.3	1 354	1 822	1 860	2.0
1908 . . .	75.8	62	79.4	1 499	1 888	1 977	4.5
1909 . . .	78.6	61	78.1	1 454	1 862	1 850	0.6
1910 . . .	78.2	60	76.9	1 417	1 843	1 812	1.7
1911 . . .	70.6	54	69.2	1 971	2 048	2 794	1.9
1912 . . .	71.6	54	69.2	1 297	1 874	1 813	3.4
1913 . . .	74.6	57	73.0	1 752	2 399	2 346	2.3
1914 . . .	70.8	58	74.3	1 972	2 594	2 723	4.7
1915 . . .	77.6	58	74.3	1 504	2 024	1 938	4.4
Means	74.4	58.1	—	—	—	—	2.5 %

623 — *Researches on Certain "Soil Sicknesses" in the Netherlands.* — SÖLMGEN, N. L., KNETEMANN, A. and WIERINGA, K. T. (Royal Agricultural Experiment Station of Groningen), in *Verslagen van Landbouwkundige Onderzoekingen der Rykslandbouwproefstations*, No. XXI, pp. 121-165 + 2 Photos, 4 Tables, 6 Fig. The Hague, 1917.

The recent appearance of various "soil sicknesses" in Holland, Germany and Denmark has lead the authors to undertake the researches described below. These sicknesses are shown by a loss in fertility of the soil, cereal crops being particularly affected. The first case, which appeared in 1905, was called "haverziekte" (oat disease) by SjöLLEMA and HUDIG, who attributed it to an excess of bases in the soil; it corresponds to the "Dörrfleckenkrankheit" described in Germany in 1914 by KRÜGER and WIMMER. Since then, fearing to make the soil too alkaline, dressings of lime have been given more and more rarely in certain localities, with the result that, in 1913 and 1914, another soil sickness appeared at Hooghalen, which HUDIG called "Hooghalensche ziekte" (Hooghalen disease). This disease chiefly affects cereals, but beets and potatoes also suffer from it. As a strongly alkaline manuring does away with the sickness and as a strongly acid manuring can, on the contrary, cause the sickness in healthy soil, it is attributed, inversely to the preceding one, to excessive soil acidity.

I. — PREVIOUS RESEARCHES. — To explain the origin of the disease,

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other experimenters, especially ABERSON, have thought that other factors were responsible : — 1) the hydrogen-ion concentration of the soil ; but researches have shown that the differences found between its values in healthy and sick soils are too small to have any influence ; 2) excess of nitrites, due to *Bacillus nitrosus*, which actively transforms nitrates into nitrites ; in fact, a minimum amount of nitrites, only a few milligrams per kilo, suffices to stop the growth of plants and even kill them.

The present report includes the authors' researches on the acidity of the soil and its influence on vegetation ; the intervention of the microbiological factors will be dealt with in a further paper.

*Properties of Humus.* — The numerous researches on the properties of humus (1) have resulted in a great diversity of opinion as regards the physical and chemical properties of this complex compound. There are 2 chief opinions : — according to SPRENGEL, MULDER, KISSLING, TACKE and SVEN ODEN the fundamental properties of humus are due to the presence of acid radicals ; while according to VAN BEMMELEN and BAUMANN, they are due to its colloidal nature.

II. — DETERMINATION OF THE CONTENT OF FREE AND COMBINED HUMIC ACID AND THE LIME REQUIREMENT. — A) WITH THE HELP OF CULTURES OF AZOTOBACTER. — 1) The authors adopted the method used by CHRISTENSEN (State Laboratory at Copenhagen) (2) in order to ascertain the soil reaction as regards the cultivation of cereals, so as to be able to control soil sicknesses in this way. Having found that *Azotobacter* was not present in soils receiving no lime, he conceived the idea of growing that organism on various soils, as an index of their acidity or basicity. He proceeded as follows : —

In 2 Erlenmeyer flasks are placed 50 cc. of distilled water, 2 % of mannite, 0.2 % of bipotassium phosphate and 5 gm. of soil ; the mixture is inoculated with the bacterium and incubated at 26° C. One flask receives a piece of chalk and serves as a control. According to whether the culture grows or not in the flask without chalk, the soil in that flask is called basic or acid.

By using this method the authors found that soil causing the oat disease did not favour the growth of the bacterium, while soils affected with Hooghalen disease, on the contrary, did, so that this microbiological method is very efficacious for ascertaining the soil reaction.

2) To determine the amount of lime required to render a hyperacid soil healthy the bacterium was again used, by adding increasing amounts of lime. The use of two species : *Azotobacter Vinelandii* and *A. chroococcum*, the former able to grow at a slightly higher degree of acidity than the latter, easily allowed of the estimation of the limit of the quantity of lime required, which is that which suffices for the growth of the first species, while it is insufficient for the second. The quantities found in

(1) See also R., January 1918, No. 8. (Ed.)

(2) See R., 1916, No. 843 and R., 1917, No. 996. (Ed.)

this way agree quite well with those obtained with the diffusion method and the probability of error is reduced to  $\pm 1784$  lb. per acre.

B) BY THE AID OF A DIFFUSION METHOD ON AGAR PLATES STAINED BY INDICATORS. — The authors made use of a diffusion method based on the fact that acids and bases, even when difficultly soluble, diffuse in a hydrogel.

If a series of small cavities are made by means of a bent, nickel spatula in a layer of agar coloured by an indicator, taking care not to pierce the layer, acids or alkalis placed in these cavities develop a surrounding zone of acid or alkaline diffusion in the agar, shown by the indicator. The sensitiveness of agar coloured by litmus is very great; a N/1000 solution of acid or alkali gives a very distinct effect; that of a N/5000 solution is still perceptible.

1) *Determination of the free humic acid content, expressed in mgm. of  $\text{CaCO}_3$  per 10 gm. of dry soil.* — This is done in a similar way to the previous one by adding increasing quantities (5 mgm. a time) of  $\text{CaCO}_3$  to the specimens. After heating for 3 hours at  $100^\circ \text{C}$ . to drive off the  $\text{CO}_2$  so as to avoid error, small samples are taken and placed in the cavities in the agar plate. Humic acid gives a red zone of diffusion,  $\text{CaCO}_3$  or  $\text{CaH}_2(\text{CO}_3)_2$  a blue zone, and calcium humate a neutral zone. The accuracy with which the free humic acid content can be ascertained is expressed in mgm. of  $\text{CaCO}_3$  per 10 gm. of dry soil, 5 mgm. for a soil that has lost 10 % by calcination, which corresponds to an error of 1071 lb. per acre; although this seems large, it should be noted that a strongly hyperacid soil often requires 1076 lb. of lime per acre to make it healthy.

2) *Determination of the excess of alkalis in a hyperbasic soil.* — The excess of alkalis still present with the humates can be determined by adding increasing amounts of  $\text{HCl}$ , instead of  $\text{CaCO}_3$ , to various 10 gm. samples. The amount of  $\text{HCl}$  required to neutralise the 10 gm. of analysed soil on the agar layer represents the excess of alkalis. In this way some "Hyperbasic" soils were found to contain an excess of nearly 26765 lb. of lime per acre.

3). *Determination of the total humic acid content (free and combined) and the calculation of the respective percentages of free and combined acid.* —

a) The metals combined with the humic acid are separated by dialysis with N/10 hydrochloric acid, or by boiling the sample with the same solution, then filtering and washing with distilled water till the  $\text{Cl}$  ions are completely eliminated. The entirely free humic acid is then titrated on the agar plate. b) To determine the combined humic acid content (always expressed in mgm. of  $\text{CaCO}_3$  per 10 gm. of dry soil) it is sufficient to subtract the known content of free acid from the total content of humic acid.

III. — APPLICATION OF THE RESULTS. — The authors have analysed a great many soil samples. For any soil, whether sand or peat, acid, neutral, or alkaline, the humic acid per gram of loss on calcination includes about 80 mgm. of  $\text{CaCO}_3$ . The humus of different soils therefore contains a constant amount of humic acid per unit of weight. It thus results that: 1) the total humic acid content may be determined directly, and the  $\text{HCl}$  method described above neglected, if the following are known: — a) wa-

ter content ; b) the loss on calcination (by means of which the total content in organic matter can be calculated) ; c) the free humic acid content. — 2) the too-acid or too-basic character of the soil depends on the percentage of free humic acid, i. e., the ratio *free humic acid : combined humic acid*. A "hyperacid" soil contains more than 60 % of free humic acid ; a healthy soil, from 50 to 60 % ; a "hyperbasic" soil, from 0 to 50 % ; in other words, if the ratio is  $> \frac{6}{10}$  the soil is "hyperacid" ; if the ratio is  $< \frac{5}{10}$  and  $> 0$ , the soil is healthy. The best percentage of free humic acid seems to be 25%.

*Influence of Fertilisers on these Sicknesses.* — Certain salts, by altering the percentage of free humic acid, especially near the roots, can have either a bad or good influence. For example, with potassium chloride, the calcium largely takes the place of potassium, and by washing is lost as soluble chloride ; as the potassium is utilised by plants, the result is an increased content of free humic acid. Magnesium chloride and ammonium sulphate have a similar effect. The contrary effect is produced by substances that diminish the content of free humic acid, as a result of the formation of compounds that can be assimilated by plants : lime, magnesium carbonate, sodium carbonate, sodium nitrate.

*Control of the Authors' methods.* — The results obtained with TACKE's method (determination of the free humic acid content by estimating the  $\text{CO}_2$  produced by the reaction soil +  $\text{CaCO}_3$ ) gave results that agreed with those obtained by the methods described in the present report. On the contrary, no efficient control could be made by comparing the results with those furnished by the method based on the determination of the hydrogen-ion concentration or by that based on the determination of the electrical conductivity (SVEN ODEN).

**GENERAL CONCLUSION.** — The direct and immediate cause of the appearance of these "soil sicknesses" has not yet been determined, but the close relation between their appearance and the free humic acid content of the soil has been established, a relation that enables the soil to be rendered healthy by means of suitable treatment.

624 — **Studies on Nitrification in Natural Soils and Its Importance from an Ecological Point of View, in Sweden.** — HESSELMANN, H. (Meddelanden från Statens Skogsförsöksanstalt), in *Skogsvårdsföreningens Tidskrift*, Year XV, No. 4-6, pp 312-446 + 30 Figs. Stockholm, 1917.

A consideration of the chief researches carried out of recent years on the chemical composition of the soil and the formation of humus (SUZUKI, ROBINSON, SCHREINER and collaborators, BAUMANN & GULLY, RINDEL, ODEN), especially as regards forest soils, leads to the following conclusions :

1) From a soil containing relatively little humus, and, to a lesser degree, peat, organic compounds of definite composition can be isolated; in certain cases, the compounds thus isolated and identified form a considerable part of the soil humus.

2) Many kinds of humus, especially those of dark colour, are largely formed of chemical compounds of undefined character.



3) The acid reaction of some humiferous soils is due to the presence of free organic acids.

4) The constituents of humus are mostly of colloidal nature, and, on account of this, the physical structure of humiferous soils is greatly influenced by the content in mineral salts or electrolytes of the soil or soil water.

The author distinguishes 2 types of humiferous soils: a) "sweet" humiferous soils, well aerated by the action of worms and insects; b) "strong" humiferous soils, formed of dead decomposed or decomposing vegetation. The former are characteristic of deciduous forests and, to a lesser degree, of pine forests on soils rich in inorganic salts; the latter, on the contrary, are found in pine forests of the ordinary type and often form a series of layers with varying stages of decomposition and which can be clearly separated from the mineral sub-soil.

The formation and distribution of nitrates in the soil directly influence its productive capacity. The dead covering always contains a certain amount of nitrogen and the knowledge of the processes by which the nitrogen becomes changed into assimilable compounds is of great importance. It is well known that the decomposition of humus is accompanied by a liberation of ammonia, which can be directly assimilated by certain plants. To determine the "degradation capacity" of a soil, it is inoculated with a sterile solution of peptones, and incubated for several days; the degree of decomposition is then ascertained by adding magnesia to the peptone solution and distilling off the ammonia into sulphuric acid. Though there are many organisms that can break up organic matter with the formation of ammonia, up to the present few are known that can change ammonia into nitrites and nitrites into nitrates: such are the nitrosobacteria and nitrobacteria discovered by WINOGRADSKY. As nitrobacteria can only act on ammoniacal compounds, the formation of ammonia appears to be an essential phase of nitrification in humiferous soils; denitrifying bacteria are also commonly found in humiferous soils, but, under normal conditions, the nitroso and nitrobacteria are much more active than the others.

According to the author, the sources of nitrogen in forest soils are: —

a) the dead, decomposing covering, to the nitrogen of which is added the atmospheric nitrogen fixed by leguminosae, alders and other plants;

b) the soil fungi and bacteria which can fix nitrogen, and which renew the energy required for this fixation by decomposing the organic matter in the soil;

c) the ammonia and nitric acid brought to the soil by rain.

In naturally wooded land, the second factor is the most important one.

The nitrogen of forest soils is lost in 3 ways: a) loss of nitrates dissolved in soil water; b) activity of denitrifying agents; c) removal of wood.

The preceding researches on nitrate formation in forest soils were carried out along 3 lines: — a) the examination of soil samples to find if nitrifying bacteria were present; b) determination of the nitrifying capacity

of the samples ; c) determination of the nitrogen content of the trees and plants at different seasons.

The author applied these different methods to the detailed study of different types of forest, obtaining the following conclusions : —

The "sweet" humus of beech woods contains as many nitrifying as denitrifying bacteria distributed in all its mass ; herbs and grasses also help considerably to increase the stock of nitric nitrogen in such a type of soil ; samples of this type of soil can form considerable amounts of nitrates if they are kept. The humus of pine forests with a mossy covering is characterised by the absence of bacteria capable of nitrifying ammonium sulphate ; denitrifying bacteria are also not present and no potassium nitrate can be found in the tissues of the plants covering the soil. The normal requirement of nitric nitrogen for this kind of forest must evidently be satisfied in some other way than by assimilation of nitrates. As regards the acidity of the dark humus soils of pine woods, the author observes that, as the colloids were coagulated by the addition of inorganic salts, it must be admitted that the humus lying on a subsoil very rich in soluble inorganic salts is less likely to give an acid reaction, because the humus particles unite and become granular, thus allowing the penetration of roots, worms and insects, all factors that favour the aeration of the soil. To support this theory, the author quotes as an example the fact that the water of peatbogs and marshy soils of the forests of Norrland on basaltic sub-soil is brown and turbid, while the same water in the limestone forest soils of Jemtland is limpid and clear.

The author remarks that, in spite of the importance of the researches carried out in the United States with the object of isolating numerous organic decomposition products partly toxic to plants, their significance should not be exaggerated, as there is not the slightest proof that such substances are present in the dark-coloured and acid humus of coniferous forests.

Many natural soils have the power of nitrification and it is characteristic that humus formation in such soils takes place under the influence of electrolytes or solutions of inorganic salts ; the formation of "sweet" humus is facilitated by the action of insects and worms that mix the soil water and humus. This is why humification, during the seasons when the salt-charged soil water flows rapidly, gives rise to forms of humus lacking the power of nitrification. On the other hand, on account of its physical constitution, "sweet" humus nitrifies, which does not take place with "strong" humus. In many places, nitrification is so rapid that a considerable amount of nitrogen accumulates in the covering vegetation ; this is best seen in dense beech, elm, oak, ash, and alder forests, especially where there is moving underground water ; in the higher mountainous regions, the soil covering also contains a considerable amount of nitrogen. In woodlands and spruce forests with grassy soil covering the nitrogen of the humus nitrifies without there usually being a resulting accumulation of nitrogen in the layer. On the contrary, plant associations on bare rocky soils are often composed of nitrophilous species that accumulate nitrogen in their tis-

sues. Again, in pine forests with a covering of lichens and mosses, the nitrogen is not nitrified and the decomposition of the dead covering gives rise to the formation of ammonia and its compounds.

Soils where nitrification is in progress are often acid and, in this case, can only slowly change ammonium sulphate to nitrate, whilst the denitrifying bacteria are usually found distributed among the moss. On the other hand, natural soils can, during nitrification, accumulate as much nitric nitrogen as ordinary cultivated soils.

Nitrification is not only largely influenced by the origin of the soil, but also by the climate, and as the degree of nitrification constitutes a powerful factor determining the composition of the plant associations of a given soil, the factors of the formation of the soil can have a decisive influence, in certain cases, on that composition. Thus, the same forest trees grow more rapidly on soils where nitrification takes place than where there is no nitrification, and a suitable forest system should make it possible to thin numerous forests in such a way as to favour soil nitrification, thus assuring a higher yield of wood; nevertheless, a good yield of pine and spruce wood can be obtained on soils where there is no nitrate formation; in this case, however, the rate of growth appears to be proportional to the rate of ammonification and the formation of the soil might well be influenced by a suitable system of forest management.

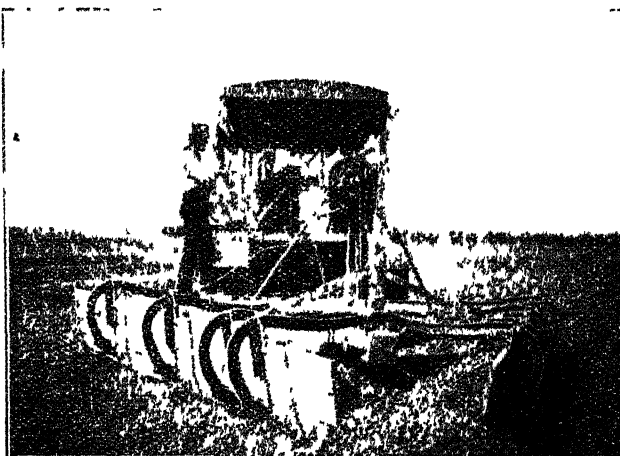
In conclusion, it should not be forgotten that lime, both in the soil and soil water, favours nitrification.

The text is illustrated by 28 photographs, constituting a useful series of ecological documents.

**625 - Irrigation of Rice in California, U. S. A.** — ROBERTSON, R. D., in *Bulletin No. 279, University of California Publications, College of Agriculture, Agricultural Experiment Station*, pp. 254-270. 7 Fig., 3 Tables. Berkeley, May, 1917.

Approximately 67 000 acres of rice were irrigated in California in 1916, the water supply being obtained principally from Sacramento and Feather rivers. Only about 37 00 acres were irrigated by pumping from wells. The land is prepared for irrigation in contour checks, preparation consisting mainly in making ditches and levees and installing gates. The gates must be wide enough to admit the large heads of water used in the initial floodings. The levees are made by means of implements described in the bulletin and amongst which the "ridger" is worthy of note. This implement, which is hauled by a tractor, is a simple, home-made affair. The appended figure shows a ridger in use, which can regulate the size of the levee. The runners for the sides are made of 3-in.  $\times$  12-in. plank, 20 ft. long and lined with steel. The front is 10 ft. wide on the bottom and the rear end 3 ft. wide on the bottom. The sides are 2 ft. high and slope outward. This implement makes a levee having a base of about 5 ft. and a height when settled of about 12 in.

On fairly even ground a crew of 2 or 3 men with a tractor will check 150 acres or more per day. Often the work is contracted and a common price paid is \$50 per day for the use of the tractor and checker.



Ridger for making irrigation levees

The irrigation season is divided into two periods. Frequent light irrigations with relatively large heads of water are given to germinate the seed and to maintain growth until the plant is 4 to 6 in. high, and thereafter the land is continually submerged to a depth of 6 to 8 in. until the rice is mature.

Measurements of the use of water in 1916 on 18 typical fields in Sacramento Valley showed a range of from 4.27 to 14.83 acre-feet per acre, an average depth applied of 8.23 feet and an average of 47 acres served per cubic foot per second.

The water used was measured by means of a standard contracted weir and an automatic register; the measurements are given in two tables.

Experiments in rice irrigation were made in 1914 to 1915, inclusive, in cooperation with the Bureau of Plant Industry, U. S. Dept. of Agriculture, on the Biggs rice field Station, the object being to determine the effect of varying irrigation treatments on the crop yield.

The results are given in the appended table (page 667).

The tests were made on  $\frac{1}{5}$ -acre plots enclosed by well-constructed levees and arranged so that they could be irrigated and drained separately.

The results of the experiments show that, on the black clay adobe soil near Biggs, 30 days after emergence of the plant is the best time for commencing submergence, and that 6 inches is probably the best depth of submergence. Very poor yields were obtained where no water was held on the land. Varying the depth of water had very little effect on plant growth. More uniform temperatures of the water were found with the greater depths of submergence.

*Effect of Irrigation Methods and Treatment  
on Yields at Biggs Rice Field Station in 1914, 1915 and 1916.*

Irrigation treatment	Yields per acre, pounds			
	1914	1915	1916	Average
Beginning submergence 15 days after emergence of plant . . . . .	4 510	3 860	3 750	4 040
Beginning submergence 30 days after emergence of plant . . . . .	5 610	4 270	4 020	4 633
Beginning submergence 45 days after . . .	—	—	—	—
Beginning submergence 60 days after . . .	5 410	4 100	3 890	4 466
Submergence maintained 2 in. deep. . . .	5 010	4 030	3 620	4 220
Submergence maintained 4 in deep. . . .	5 490	4 290	3 760	4 513
Submergence maintained 6 in deep. . . .	5 670	4 510	3 920	4 693
Submergence maintained 8 in deep. . . .	5 220	4 400	3 940	4 520
Slowly changing water. . . . .	4 790	4 210	3 460	4 153
Stagnant water . . . . .	4 940	3 990	3 800	4 243
No submergence (soil kept moist by frequent irrigation) . . . . .	2 440	2 480	2 100	2 340
Fluctuation of depth. . . . .	5 290	4 160	3 690	4 380

626—On Green Manures. — SCHRIBAUX and BRÉTIGNIÈRE, L., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 10, pp. 354-357 and 360-365. Paris, March 13, 1918.

MANURES  
AND MANURING

M. SCHRIBAUX (professor of the "Institut National Agronomique") communicated to the Academy a note by M. BRÉTIGNIÈRE (professor of Agriculture at the "Ecole Nationale d'Agriculture" at Grignon) in which M. BRÉTIGNIÈRE describes the results he obtained with clover and black medick as green manures. The sowing of these two Leguminosae in cereal fields is highly recommended. The practice, which is already adopted in some cases, should be general, especially in view of the shortage and high price of nitrogenous manures. By this means, as at Grignon from 1913 to 1916, the growing of three successive cereal crops becomes possible. The following table shows the difference in yield obtained when oats were sown on green manure as compared with that grown in the control plots; in each case the difference is in favour of green manure.

	Grain cwt. per acre	Straw cwt. per acre
Oats on black medick . . . . .	8.95	14.96
» » clover . . . . .	6.27	10.79
» » vetch. . . . .	4.32	4.84
» » white mustard . . . . .	0.42	1.14

The superiority of the black medick and clover is obvious, especially that of the black medick, which has the further advantage of costing only

£4.14.0 to £5.6.0 per cwt., whereas clover costs from £7.2.0 to £8.2.0 per cwt.

Besides the black medick and clover recommended by M. BRÉTIGNÈRE, M. SCHRIBAUX also advises the use as green manure of crimson clover, which is to be recommended on account of its rapid growth and the relatively low cost of its seed. Fentugreek might also be useful for the same purpose, especially in the south of France, on account of its hardness and well developed roots. The adoption as a green manure of white melilot, already used as such in America, might also be studied.

627 - **Fertilizers in South Africa** — in *The South Africa Journal of Industries*, Vol. I, No. 5, pp. 465-467. Pretoria, 1918 (1)

The growing scarcity of fertilizers has long been evident to the South African agricultural community, and the Minister of Mines and Industries, in his address to the Scientific and Technical Committee at their inaugural meeting in Capetown on April 17, 1917, especially commended this urgent question to their consideration as an important subject for investigation and research.

In accordance with this mandate the Committee at once commenced inquiries in various directions, especially with the object of ascertaining what practical possibilities existed of replacing imports by locally manufactured fertilizers. The large amount of fertilizer imports and their steady decrease since the war began are illustrated in the following table, but at the present time importation has practically ceased, and there is no available supply to make good the deficiency.

*Imports into South Africa of Manures and Fertilizers, 1913-16*  
(compiled from *Eleventh Annual Statement of Trade and Shipping*, 1916).

	1913		1914	
	Quantity lb.	Value £	Quantity lb.	Value £
Basic Slag . . . . .	11 939 558	11 411	13 664 963	13 786
Bone Manures . . . . .	9 427 746	20 103	8 800 433	18 203
Guano . . . . .	701 553	1 205	2 256 563	4 907
Nitrate of Soda . . . . .	146 496	087	50 016	227
Phosphates, raw . . . . .	1 522 433	1 705	755 100	1 185
Potash Manures . . . . .	3 994 560	18 107	1 427 893	6 181
Sulphate of Ammonia . . . . .	790 075	4 707	463 126	2 408
Superphosphates . . . . .	82 026 936	95 273	73 672 158	88 103
All other N. O. D. . . . .	17 166 069	35 233	18 211 668	45 742
	1915		1916	
	Quantity lb.	Value £	Quantity lb.	Value £
Basic Slag . . . . .	18 054 306	21 029	12 461 056	20 614
Bone Manures . . . . .	4 038 216	8 776	286 720	905
Guano . . . . .	1 453 228	2 849	37 614	92
Nitrate of Soda . . . . .	—	—	2 588	15
Phosphates, raw . . . . .	—	—	—	—
Potash Manures . . . . .	61 312	672	—	—
Sulphate of Ammonia . . . . .	134 175	788	101 224	793
Superphosphates . . . . .	67 822 467	110 143	40 039 728	89 825
All other N. O. D. . . . .	13 095 937	31 079	7 885 294	14 504

(1) See INT. INST. OF AGR. *Production et consommation des engrais chimiques dans le monde* II ed. 1914 and the half-yearly reviews *The International Movement of Fertilizers and Chemical Products useful to Agriculture*. (Ed.)

As is generally recognized, South Africa's fertilizer requirements, in descending order of importance, are the various forms of phosphoric oxide, nitrogen and potash. South African soils are usually not so deficient in the last-mentioned item as in the others, and deficiencies can be partially supplied by kraal manure. Phosphates are needed for maize and practically all other crops to promote root growth for withstanding drought and ensuring early maturity, whilst nitrogen is a prime requisite for wheat and sugar crops. The fact that South Africa imports so much of its food supplies under normal conditions (even at the present time wheat and wheat products are imported to the extent of nearly £ 2 000 000 yearly) makes the present necessity still greater for stimulating local food production, and for this purpose the utilization of fertilizers from various local sources must play a most important part. Apart from the serious drain on the country's wealth in payment for food and fertilizer imports from overseas, the exigencies of shipping shortage may, as the Minister recently stated in public, cause a total cessation of wheat imports.

The Scientific and Technical Committee has surveyed the problem in its various aspects and the inquiries started include : South African guano supplies ; the increased employment of green-manuring ; the use of ground limestone ; the possible utilization of woolwashery and sawdust waste, and of kelp for supplies of potash ; cotton-seed by-products ; locally produced ammonium sulphate ; the supply of phosphates from the Seychelles and elsewhere ; and the possible utilization of Saldanha Bay and other local phosphate rocks. Eventually the main centres in the Union were visited to investigate abattoir and fishery refuse production, and it was ascertained that much waste existed in the discarding of potential phosphatic-nitrogenous fertilizers. For instance, at the most important abattoir in the Union, 80 per cent. of the offal was buried at considerable cost owing to inadequacy of plant for conversion into a high-grade fertilizer for which the demand far exceeded the supply. For similar reasons 12 000 tons yearly of potential crayfish fertilizer was thrown into the sea, and at many other centres waste occurred which, though often individually small, accounted in the aggregate for a considerable quantity. Steps were then taken by the Engineering Sub-Committee of the Scientific and Technical Committee to ascertain whether fertilizer plants could not be locally constructed so as to avoid delay from restriction by machinery importation.

In the meantime strenuous efforts are being made by those interested to convert the large deposits of iron-alumina phosphates known to exist in South Africa into a form suitable for agricultural use, and the technical aspect of this known problem is attracting much attention in South Africa. Inquiries are also being made as to the extent and nature of alleged phosphatic deposits in South-West Africa and elsewhere, and the chemists of the Department of Agriculture and others have periodically published articles on the proper use of fertilizers, great being the need for this educational propaganda.

At the present time about 200 tons per month of ammonium sulphate is being produced from coal at the works of the Natal Ammonium Company

but practically all this is exported to Mauritius for use in sugar growing. Very little is used in the Union, but export is only allowed after all local demands are satisfied. Should the oil-pressing industry in South Africa grow to provide more fully for local glycerine requirements, this would result in increased oil-cake production. Of this by-product, Mafureira (1) and castor oil-cake are unsuitable for stock food, owing to their poisonous properties, but as fertilizers they provide nitrogen and some phosphoric oxide and potash at a cost much less than in the more usual form of nitrogen fertilizers.

628 — **Plants Imported into the United States by the Bureau of Plant Industry of the Department of Agriculture, during the Half-Year July 1 to December 31, 1917** (2).

— U. S. Department of Agriculture, Bureau of Plant Industry, *Inventory of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction: I. During the Period from July 1 to September 30, 1914* (Inventory No. 40; Nos. 38 666 to 39 308), pp. 110 + 10 Plates; *II. During the Period from October 1 to December 31, 1914* (Inventory No. 41, Nos. 39 309 to 39 681), pp. 67 + 4 Plates. Washington, 1917.

Of the many newly-imported plants the following are mentioned as being of special importance: —

I. — **CEREALS.** — A collection of 13 varieties of the grass *Coix Lacryma-Jobi* (from Burma), some of which produce soft grain and are cultivated for food; 33 varieties or species of the maize characteristic of Copacabana, Peru; 5 varieties of maize from Yachow, western China; a collection of sorghum varieties from Java; 20 varieties of rice from Java; the 2 commercial varieties of rice grown in Valencia, Spain (3).

**FORAGE PLANTS.** — The Australian Rhodes Grass (*Chloris virgata* var. *decora*) which has done exceedingly well on clay-pan, wind-swept and sun-scorched soils, where other grasses are difficult to grow; 12 species of forage grasses (*Andropogon erianthoides*, *Alloteropsis Ekloniana*, *Eragrostis curvula*, *E. poa*, *Fingerhuthia africana*, *Ischaemum glaucostachyum*, *Panicum maximum*, *P. nigropedatum*, *Chaetochloa aurea*, *C. Lindergiana*, *C. nigrirostris*, *C. sulcata*) from S. Africa, some from the Kalahari desert region, and some from the Transvaal and Caldeon coast district; if any of these plants prove as valuable as the Rhodes grass, from the same climatic district, their introduction will be a decided gain. The following plants are also valuable acquisitions: — 1 cowpea (*Vigna sinensis*), called "im-

(1) *Trichilia emetica* Wahl. supplying oleaginous seed. (Ed.)

(2) See R. Feb., 1918, No. 138. (Ed.)

(3) The two commercial varieties of rice grown in the Valencia district, especially on the banks of the Jucar, are the "Benlloch" or "Belloch" and "Amonquili". In 1913, 80 % of the first variety and 20 % of the second was grown, and the first is being grown in continually increasing quantities. The origin of the "Benlloch" variety is uncertain. It was introduced and distributed to growers by the Agricultural Station of Burjasot, near Valencia. It was immediately acclimatised and seems particularly well suited to the soil. It germinates easily and is resistant to transplanting, which is a common practice in the district; the straw is strong. It ripens, however, somewhat later than the other varieties, and its food value is said to be inferior to that of the "Bomba" variety. In 1913, "Benlloch" rice gave an exceptionally high yield, as much as 4.42 tons per acre, and was sold on the threshing floor at \$4.86 per 220 lb.



boomba", grown for food by the Zulus of S. Africa; 1 selected forage sugar cane, called "quacsofoca", which in Queensland has proved superior to all the old standard types by its hardiness, yield, softness and food value; *Erianthus rufipilus*, from the Himalayas; *Pollinia fulva*, from the interior of Australia, much relished by cattle; *Eriochloa subglabra* ("capim angolinha") from Brazil.

VEGETABLES. — A fine variety of the winter "pe-tsai", or Chinese cabbage (*Brassica pekinensis*) with very white heads of a mild flavour; 2 species of rhubarb (*Rheum acuminatum* and *R. nobile*), from Darjiling, India, the two species might be hybridised with *R. rhaponticum*; 22 varieties of cassava (*Manihot esculenta*), representing the most important varieties grown in the State of Bahia, Brazil; a variety of pumpkin (*Cucurbita Pepo*), from the Oasis of Merv, Turkestan, which has withstood the heat and drought of Sonora, Mexico, better than any other variety tested there; 1 long, blood-red carrot (*Daucus Carota*) for pickling, from Sianfu, China; a shrubby species of indigo (*Indigofera dosua*), from the temperate Himalayas, the flowers of which are eaten as a vegetable, while the plant is used for fodder.

FRUIT TREES. — *Feijoa Sellowiana* remarkable for its large fruit (3  $\frac{1}{2}$  × 2  $\frac{1}{2}$  inches) from Pasadena, California; the Pelese apricot from Somma Vesuviana, Italy, with very firm flesh, fine flavour and good shipping qualities; the "wampi" (*Claucaena lansium*) with fruit related to the orange, which promises to be a good stock for the orange and grapefruit: a vigorous tropical vine (*Vitis tiliæfolia*), the fruit of which is good for jelly, and which may be used for producing good-quality varieties of tropical grapes; 6 varieties of "kuruba" (*Passiflora maliformis*), the fruit of which is much appreciated in the Bogota market, especially that of a red-fruited variety; *Eriobotrya petiolata*, from the eastern Himalaya district, which may prove valuable as a stock for the loquat; the Luisa mango (*Mangifera indica*) with excellent fruit, from Cuba, though the seed is probably of Philippine origin; a quantity of "litchi" seeds (*Nephelium Litchi*) from trees in the Hawaiian Islands; *Pouzpartia axillaris*, a fruit and shade tree from the western Hupeh and Szechwan Provinces of China, which has proved hardy in Georgia; *Sorbus cuspidata* and *S. insignis*, natives of the Eastern Himalayas; *Dillenia pentagyna*, from Oudh, Bengal, Assam and Burma, the flowers, buds and green fruit of which are eaten by the natives; *Rubus niveus* from Kashmir and Sikkim, a Rambler bearing fruit superior to that of the English blackberry.

ORNAMENTAL, SHADE AND WIND-BREAKING TREES. — The 80-foot high, wild, pink-flowered cherry of Japan (*Prunus serrulata sachalinensis*), which deserves to be widely planted on account of its hardiness and beauty; the Nepal ash (*Fraxinus floribunda*), which, though not hardy in England may prove to be so in the south of the United States; the East African Cedar (*Juniperus procera*) from Eritrea, the wood of which makes better pencils than those of the American juniper; *Balanites Maughamii*, a native of Portuguese East Africa, from the seeds of which a clear, yellow, odourless oil is obtained; *Picea Smithiana*, from Darjiling, India, the wood of which

is used for packing-cases and charcoal; *Aesculus assamicus*, from northern Bengal; *Tilia mongolica* from Tahuashan, China; 3 varieties of the Chinese soap-bean tree (*Gleditsia sinensis*), remarkably resistant to drought and alkalinity, and very ornamental because, all through winter, they bear their pods, which are very rich in saponin; the cigar-boxwood tree (*Toona sinensis*) from Changli, China, a fine shade and ornamental tree which also gives good timber; *Corylus ferox*, the edible Nepalese hazelnut; a large bamboo (*Dendrocalamus Hamiltonii*), from Darjiling, with shoots 80 feet high, the young sprouts of which are edible, it might prove hardy in the south of the United States and be used as a windbreak; *Cotoneaster microphylla*; 18 species of Himalayan rhododendron:—*Rhododendron anthopogon* (a shrub about 2 feet high with sulphur-coloured flowers), *R. arboreum* (often attaining a height of 25 feet), *R. arboreum Campbelliae*, *R. arboreum* Smith, *R. barbatum*, *R. camelliaeflorum*, *R. campanulatum*, *R. campylocarpum* (with pale yellow flowers), *R. ciliatum*, *R. Roylei*, *R. Dalhousiae*, *R. Falconeri* (admirably adapted to the parched, arid climate of Tibet), *R. fulgens*, *R. grande*, *R. lanatum* (with pale sulphur-coloured flowers), *R. Lepidotum*, *R. setosum*, *R. Wightii* (with pale yellow flowers); a Nepal barberry (*Berberis nepalensis*), which, in Nepal, flowers from October to March; *Polygonum vacciniifolium*, an autumn-flowering plant very popular in England; 3 forms of evergreen shrubs (*Euonymus* spp.), from Tahuashan, in the Shensi Province of China.

II. *Edible plants.*—A collection of 38 varieties of Chinese barley, which it is hoped will yield good new varieties in some parts of the United States; 8 varieties of sweet potatoes from the Cuba Experiment Station; 1 wild tomato of Funchal which grows wild among the dry rocks of the Island of Madeira, believed to be from the original stock from which the cultivated tomato is descended, it is very resistant to drought and will probably prove valuable in selection work; the "Mahwa" tree (*Madhuca indica*), the fleshy flowers of which produce annually in India food worth over a million dollars has been imported into Florida and Porto Rico.

LEGUMINOSÆ USED AS GREEN MANURE AND FODDER LEGUMINOSÆ.—The Sarawak bean (*Dolichus Hosei*) is used as a cover crop to keep down weeds in rubber plantations in the Malay States, and could be used for the same purpose in the citrus orchards of Florida; 1 wild, prostrate form of alfalfa from the mountains between Hotien, Honan, and Luanfu, Shansi province, China.

TEXTILE PLANTS.—The "chingma", also known as Chinese jute or Tientsin fibre (*Abutilon Theophrasti*), which yields a harsher and stronger fibre than Indian jute and is used for carpet-making; it was imported from Ichang, China, and, if improved methods for extracting the fibre be found, may prove of value in America; seeds of *Kokia drynarioides* (closely related to cultivated cotton, but now almost extinct) have been imported from Molokai.

ORNAMENTAL AND WIND-BREAKING TREES.—The "doorn-boom" of the S. African veldt (*Acacia horrida*) is promising as a hedge and wind-breaking tree in Texas; 2 species of Tamarix (*Tamarix pentandra* var. *brachystachys* and *F. Karelini hirta*), have been imported from the desert

of Farab, Bokhara, Turkestan, in view of the good results obtained in Texas with *Tamarix* as low windbreaks; the Himalayan *Rosa odorata gigantea*, with white flowers 6 inches across, a climbing rose which may be crossed with others; the most beautiful flowering tree of Java, *Spathodea campanulata*, imported from Africa into the island, where it flowers almost all the year; as it has flowered in southern Florida new importations have been made.

**FRUIT TREES.**—The rapid growth of avocado (*Persea gratissima*) groves in California and Florida and the ever-growing appreciation of the value of the fruit, which contains over 29 % of fat, make the Guatamalan and Mexican hard-shelled varieties of much interest, they ripen in spring and winter and have remarkable shipping qualities; they have of late years been grown in California; a Ceylonese mango, almost as large as a coconut, of a bright red colour and with almost no fibre; a *Feijoa Sellowiana* seedling, with exceptionally large fruit; this species has proved exceedingly hardy in the south of the United States; 1 rosy-fleshed anona, called "ilama" (*Annona diversifolia*), one of the best of this class of fruit, and *A. purpurea*, with large aromatic fruit; 1 Chinese "wampi" (*Claucena lansium*) which grows well in Florida and may be cultivated for its fruit; 1 variety of coconut rich in oil, from Punta Burica, Panama; 4 varieties of apples resistant to the woolly aphis (*Eriosoma lanigera*); *Pyrus betulaeifolia* sent by Dr. BRETSCHNEIDER to the Royal Botanical Gardens, Kew, and the Arnold Arboretum, Jamaica Plain, Massachusetts, it may be used as stock and should be useful in selection work; *P. Bretschneideri*, very valuable as an ornamental tree, and yielding yellow, round, juicy fruit; according to SARGENT the best Chinese pear trees are derived from this variety; *P. ovoidea*, which is probably the parent of the KIEFFER blight resistant pear, it has large, abundant flowers, and foliage that turns scarlet in autumn; *P. phaeocarpa*, with pyriform fruit, which appears to be immune to blight (*Bacillus amylovorus*), for a large tree in the Arnold Arboretum for many years has never contracted the disease although exposed to infection. This collection of Chinese pear trees, made by the Arnold Arboretum, will facilitate a comparative study of Chinese species (from which KIEFFER and LE CONTE obtained their blight resistant pears, by crossing and selection) and the determination of their value for grafting and selection purposes; a wild apricot from the Shansi Province of China, where the natives pickle the kernels in brine and eat them as an appetiser; 2 small, sour, wild free-stone peaches from Sianfu, Shensi Province and Chaoyu, Shansi Province, China, respectively; *Prinsepia uniflora* from near Fucheng, Shansi, China, a hardy, shrub, bearing dark red, juicy and sour fruit resembling cherries.

629 — The Separation of Autogenous and Added Hydrocyanic Acid from Certain Plant Tissues and its Disappearance during Maceration. — ALSBERG, CARL L. and BLACK, OTIS F. (Office of Drug Plant, Poisonous Plant, Physiological and Fermentation Investigations, Bureau of Plant Industry, United States Department of Agriculture, Washington), in *The Journal of Biological Chemistry*, Vol. XXV, No. 1, pp. 133-140. Baltimore, Md., May, 1916.

In this paper it is shown that the leaves of *Prunus virginiana* must be

distilled with acid 4 hours before all of the hydrocyanic acid is liberated, whereas in *Andropogon* and *Panicularia* less than 1 hour is sufficient to liberate all hydrocyanic acid present. It is further shown that in macerating plant tissues that contain hydrocyanic acid a certain amount of the hydrocyanic acid present or of cyanide that may be added is so converted that it is not recoverable by distillation with sulphuric acid. This is not due to the action of enzymes or to the presence of glucose. It is thus shown that in determining hydrocyanic acid in plants several methods in corroboration of each other must be used.

630 — **The Direct Influence on the Stock of the Sap produced by the Scion, and the Action on the Plant of Acid Solutions Absorbed Directly: Experiments in Italy.**

— CAMPBELL, C., in the *Atti dell' Reale Accademia dei Lincei*, Series V, *Rendiconti*, Vol. XXVIII, 1st. Half-Year, No. 1, pp. 57-61 Rome, January 6, 1918

Plants that are wild or have become so are usually more resistant to parasites than cultivated plants; this has suggested the hypothesis to Prof. COMES that this difference in behaviour is due to the greater acidity of the sap of wild plants (1).

The author has tested Prof. COMES' hypothesis in two different ways: 1) by grafting a wild plant on a cultivated plant of the same genus (plum on peach or wild apple on an ungrafted apple) and studying the influence on the latter of the sap produced by the former; 2) by making the plant take up acid solutions through its aerial parts by the method of Prof. ACQUA (*Rendiconti della R. Accademia dei Lincei*, 1914).

**ACTION OF THE SAP PRODUCED BY THE WILD SCION ON THE CULTIVATED STOCK.** — If Prof. COMES' hypothesis is correct, the sap produced by the scion, being more acid, should increase the resistance of the stock to parasites. This was confirmed experimentally; in fact, after the 2nd and 3rd year of grafting, the influence of the scion on the stock is shown by the deeper colouring of the leaves of the cultivated plant (more marked in the peach) and its greater resistance both to drought and certain parasites: in the peach, against *Expasculus deformans*; in the apple, against *Oidium farinosum*.

**DIRECT ABSORPTION OF ACID SOLUTIONS BY THE AERIAL PARTS.** — Up to the present, the author has studied 0.5, 1 and 2 % solutions of tartaric, citric and malic acids in pure distilled water or plus a little saccharose to vary the osmotic pressure. By means of a cut branch immersed in water, an apple-tree heavily attacked by *Myzoxylus laniger* (= *Schizoneura lanigera*) and peach-trees heavily attacked by the aphid *Amuraphis persicae* (= *Aphis persicae*) were made to absorb acid solutions at first in 1915, then in 1916 and 1917. In the spring of 1917, it was found that, as regards the apple-tree which had absorbed the acid solution, the *Myzoxylus laniger* had almost completely disappeared and that, in comparison with the controls, the upper leaves were better developed and of a deeper green. The infection with the conidial form (*Oidium farinosum*) of *Podosphaera leucotricha*, with which all the other ungrafted plants were attacked, did not affect the plant in question or the wild plants. Of the 2 peach-trees most

(1) See B., 1913, No. 881; 1914, No. 978; R., 1916, No. 937. (Ed.).

severely attacked by the aphids, the one that had absorbed the acid solutions (and which was in worse condition than the other at the beginning) has survived, while the one that was not treated died.

The author has the intention of continuing and enlarging these researches, and he considers it will be useful to try again the influence of an American vine-scion on a European stock, as regards resistance to phylloxera, to establish the value of the change taking place in the chemical conditions and to include the direct absorption of liquid in his experiments.

**631 - The Influence of Acids on Germination (1).** — MAQUENNE, L. and DEMOUSSY, E., in the *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 14, pp. 547-552. Paris, April 8, 1918.

Up to the present there is no precise information available as to the influence of acids on germinating seeds. It is certain that they are injurious at concentrations of 1/1000, but nothing is known as to the minimum at which they begin to take effect. The latest work on this subject has been carried out by Mlle PROMSY (2) and M. MICHEELS (3).

For their experiments the authors used peas and wheat, previously swollen by soaking in pure water for 24 hours. The experiments were carried out in two ways: — in saucers, in sand soaked with weak hydrochloric or sulphuric acid, and in quartz tubes filled with the same solutions 100 times more dilute.

**CONCLUSIONS.** — Mineral acids should be placed among the substances that are most injurious to germination. Their toxic action which, when the acid is free from other substances apparently cannot be changed to a favourable one, can be modified by the presence of electrolytes of salts.

In this, acids behave like all other mineral poisons: especially harmful when acting alone, they are sensitive to the influence of antitoxins amongst which calcium appears to be one of the most powerful. And, as with the salts of heavy metals, mineral acids sensibly diminish the efficacy of calcium sulphate.

**632 - Some Effects of Organic Growth-Promoting Substances (Auximones).** — I. BOTTOMLEY, W. B. (Professor of Botany, University of London), Some Effects of Auximones on the Growth of *Lemna minor* in Mineral Culture Solutions, in the *Proceedings of the Royal Society (Biological Sciences)*, Series B, Vol. 89, No. B621, pp. 481-507 + 13 Tables + 7 Fig. + 2 Pl. London, 1917. — II. MCKERIDGE F. A. (King's College, London), Some Effects of Auximones on the Soil Organisms concerned in the Nitrogen Cycle. *Ibid.*, pp. 508-533, + 15 Tables, 1917.

I. — In a previous communication (3) the author showed that bacterised peat (4) contains certain organic growth-producing substances which he calls "auximones" and which, when added in very small amounts to wheat seedlings growing in water culture, cause a marked increase in growth.

(1) See R., September 1917, No. 803. (Ed.) — (2) Thesis No. 1479 of the Science Faculty of the University of Paris. Marseilles, 1912. — *Bull. Acad. Royale de Belgique*, Science Section, 1913. (Author).

(3) See R., January 1917, No. 21. — (4) See B., 1914, No. 1102. (Ed.)

The author started fresh experiments with *Lemna minor*, a plant whose rapid growth can be easily noted. A number of comparative culture tests (control cultures in Detmer's culture solution — cultures in that solution plus small quantities of extracts of bacterised peat as : - a) aqueous extract ; b) alcoholic extract ; c) phosphotungstic acid fraction ) have led to the following observations :—

1) The auximones contained in bacterised peat have an enormous influence on the growth of *Lemna*, even when added in small quantities: the plants grow in number and weight, the cells are larger, the protoplasm is denser, the nucleus larger and the chloroplasts are more numerous.

2) In *Lemna* normal growth and multiplication cannot be sustained for any length of time in the absence of auximones in an exclusively mineral solution ; auximones are essential for the effective utilisation and assimilation of the mineral substances supplied to these plants.

The addition to the mineral culture solution of 368 parts per million of organic matter from the water extract of bacterised peat resulted, after 6 weeks, in multiplication of the number to 20 times, and an increase in weight to 62 times, that of the control plants.

3) It is highly probable that these auximones are organic decomposition products, for bacterised peat is simply organic matter, already partly decomposed by anaerobic action, which has been further decomposed by the agency of aerobic bacteria under suitable conditions. Some of them may be absorbed and utilised directly as plant nutrients. SCHREINER and SKINNER have shown that such nitrogenous decomposition products as creatinine, histidine and arginine can replace nitrates in a culture solution, and that, even when nitrates are present, these substances are absorbed by the plants ; these compounds are absorbed as such and utilised directly for building up the proteins and other complex nitrogenous constituents of vegetable material. They also suggest that the energy required for the transformation of inorganic nitrogen into an organic form being no longer required, it can be expended otherwise when these substances are supplied to the plant and results in more rapid growth and increased plant efficiency. Other auximones may have a similar effect to the accessory food bodies or growth vitamins concerned in animal growth, which would explain the enormous effect produced in comparison with the quantities present.

5) The great sensibility of the plant to the action of these substances is shown clearly when the quantity of auximones is progressively diminished or when the culture solutions are exchanged.

6) The fact that plants can grow in exclusively mineral solutions does not constitute an objection to the suggestion that the presence of organic substances is necessary, for BROWN has shown that nitrogenous organic growth-promoting substances may be produced in the endosperm during germination and absorbed by the embryo.

II. — The author has made different cultures of the organisms concerned in the nitrogen cycle (nitrogen-fixing, nitrifying, ammonifying and denitrifying bacteria), which were mixed with extracts of bacterised peat. The results of the researches indicate that : —

1) Soluble humus is a very important factor from the point of view of the activities of soil bacteria. Its effect on the organisms appears to be largely independent of any organic matter it may contain; it is shown to be due to the presence of auximones;

2) auximones increase the rate of nitrogen fixation and nitrification, depress the rate of denitrification, and do not appreciably affect the rate of ammonification.

If auximones play some definite part in the building up of the complex nitrogenous molecules of the organism, it follows that a directly opposite effect should be produced on the two classes of bacteria (nitrifying and denitrifying) whose activities are directed upon such widely divergent lines.

633 — **Translocation of Seed Protein Reserves in the Growing Maize Seedling.** — PETTIBONE, C. J. V. and KENNEDY, CORNELIA (Biochemical Laboratory, Department of Physiology of the Medical School, University of Minnesota, Minneapolis), in *The Journal of Biological Chemistry*, Vol. XXVI, No 2, pp. 519-525, 2 Diagr. Baltimore, Md., September, 1916.

In view of the establishment of the fact that in animals the proteins of the food enter the blood stream and are transported to the tissues at least in large measure in the form of amino-acids, the authors have judged of interest to settle the same problem in connection with the transference of reserve seed proteins in plants and have undertaken the study of the form in which the reserve proteins of the kernel are transported in the growing maize seedling. The conclusion arrived at from the results is given below:—

It is clear that amino-acids are present in the flowing sap of maize seedlings. Since these compounds are present at all times in seed, rootlet and plumule, their presence in the flowing sap coupled with the migration of nitrogen, indicates beyond question that the process of transportation of the reserve proteins of the seed, to furnish building material for the proteins of the growing parts, takes place in a manner analogous to the transportation of protein food supplies in the animal organism. The appearance of a slight cloudiness when the sap was mixed with alcohol, and the relatively slight increase in amino-acid nitrogen after hydrolysis suggest, however, that a portion of the nitrogen may be transported in the form of soluble protein or protein hydrolytic products of peptide type.

634 — **The Origin of "Humpback" Wheat by Selection.** — See No. 642 of this Review.

PLANT  
BREEDING

635 — **Two New Varieties of Field Pea Obtained by Pure Line Selection, in Norway.** — CHRISTIE, W., in *Aarsberetning angaaende de offentlige foranstaltninger til Landbrugets fremme i aaret 1916*, pp. 515-518. Christiania, 1917.

The field pea (*Pisum arvense*) cultivated in Hedemarken (Norway) consists of a mixture of forms that differ in their yield of seed and straw, in their earliness, and other characters.

The article under consideration gives the results of researches carried out with the idea of isolating the best of the different forms. Thus, in 1905 and 1906, a choice was made from 118 and 225 specimens (destined to serve as parents for the new lines) in the localities of Nordre Lund and Buttekvaern, province of Furnes. A series of comparative trials, with progressive elimination of unpromising types, gradually reduced the number

of lines to 2 only, which were worth considering as valuable new varieties. These were "Möistad gulgrönne ert" (Möistad yellow-green field pea) and "Möistad brandede ert" (Möistad mottled field pea), entered in the genealogical register as No. 0203 and No. 0402.

As regards the yield of the different varieties and the length of their growing period, the following data is available for the 4 year period 1909-1912:

**YIELD IN SEED.** — The mottled field pea 0402 (relative yield: 100) takes first place with an average of 2248 lb. per acre, *i. e.*, 946 lb. more than the common Hedemarken field pea (relative yield: 83) and 242 lb. more than the yellow-green field pea 0203 (relative yield: 96), which only surpassed it in yield in 1911.

**YIELD IN STRAW AND EARLINESS.** — Both mottled and common field pea give practically the same yield in straw (3729 lb. and 3899 lb. respectively per acre) while the yellow-green field pea (3131 lb. per acre) gives a much inferior yield to both the others, probably on account of its earliness. In fact the length of the growing period is 109 days for the yellow-green field pea, 118 days for the mottled field pea, and 116 days for the common field pea. The more early a variety is, the smaller is the amount of green parts that it produces.

The following are the chief characters of the two new varieties: —

1) Möistad yellow-green field-pea No. 0203 — It is a form of *Pisum arvense* var. *unicolor* ("ensfarvet graaert") which differs from the common Hedemarken field pea in greater earliness and bigger yield of seed, while it is slightly inferior as regards yield in straw. The seeds are round, small, and of a fine yellow-green colour.

2) Möistad mottled field pea No. 0402. — It is a form of *Pisum arvense* var. *punctato-maculatum* ("prikket-marmoreret graaert") It is clearly superior to the common Hedemarken field pea for yield in seed, while retaining the useful earliness and high yield in straw that characterise the common variety. The seeds are mottled with brown on a grey-green ground, thus giving it its name 'mottled' field pea.


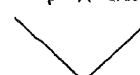
636 - **Maternal Inheritance in the Soy Bean.** — TERRAO, H., in *The American Naturalist*, Vol. LII, No. 613, pp. 51-56 New York, January, 1918

The cotyledons of the soy bean (*Glycine hispida* Maxim.) may be green or yellow. In the first case the seed-coat is always green, in the second it is either green or yellow. The results of the author's experiments since 1910, summarised below, show that these colours are transmitted by the maternal plant only.

1) **TRANSMISSION OF THE COLOUR OF THE COTYLEDONS.** — Reciprocal crosses between varieties with yellow cotyledons and with green cotyledons give, in the  $F_1$ , hybrids of the same character as the female parent. In  $F_2$  this phenomenon is repeated without there being any Mendelian segregation of characters such as might be expected. Table I illustrates the results.

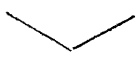
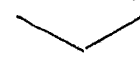
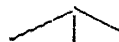


TABLE I. — *Transmission of the colour of the cotyledons.*

Parents . . . . .	green ♀ × yellow ♂	yellow ♀ × green ♂
		
F <sub>1</sub> . . . . .	Plants with green cotyl. 100 %	Plants with yellow cotyl. 100 %
F <sub>2</sub> . . . . .	Plants with green cotyl. 100 %	Plants with yellow cotyl. 100 %

2) TRANSMISSION OF THE COLOUR OF THE SEED COAT. — This is more complicated. In the cross *Green* ♀ × *Yellow* ♂ (See Table II) the colour of the seed coat is transmitted exclusively by the female plant, as in the case of the cotyledons. The cross *Yellow* ♀ × *Green* ♂, however, gives in F<sub>1</sub> hybrids with yellow cotyledons and green seed coats, and in F<sub>2</sub>,  $\frac{3}{4}$  of the individuals have green seed-coats and  $\frac{1}{4}$  yellow seed coats according to the Mendelian ratio 3 : 1.

TABLE II. — *Transmission of the colour of the seed coat.*

Parents . . . . .	Green ♀ × Yellow ♂	Yellow ♀ × Green ♂
Colour of cotyledon . . . .	green      yellow	yellow      green
Colour of seed-coat . . . .	green      yellow	yellow      green
		
F <sub>1</sub> . . . . .	100 % green	100 % yellow
Colour of cotyledon . . . .	green	green
Colour of seed-coat . . . .	green	green
		
F <sub>2</sub> . . . . .	100 % green	25 %    50 %    25 % yellow   yellow   yellow
Colour of cotyledon . . . .	green	green   green   yellow
Colour of seed-coat . . . .	green	green   green   yellow

EXPLANATION OF THESE PHENOMENA. — The behaviour of the chlorophyll of the aerial parts of the plants is identical with that of the cotyledons; when the plant ripens the leaves and stem of individuals with yellow cotyledons turn yellow, whereas, in plants with green cotyledons, the parts keep their green colour without changing for a longer period. There are, then, two types of chlorophyll: — Y, which can be changed to yellow and, G which remains green. Both of these characters probably have their seat in the cytoplasm of the egg-cell, and are, thus, transmitted directly by the female plant.

The action of the chlorophyll of the seed coat, however, which may be green even in plants with yellow cotyledons, is probably due to the presence of a factor *H*, which prevents *Y* from colouring the seed coat yellow, so that it remains green even in the absence of *G*. The absence of the inhibitory factor *H* is expressed by *h*. In varieties with *G* chlorophyll the presence or absence of *H* is shown by the varying intensity of the green.

These facts make possible an explanation of the phenomena described above. Thus the cross *green* ♀ × *yellow* ♂, with the formula (*G*) *HH* ♀ × (*Y*) *hh* ♂, gives in *F*<sub>1</sub> a hybrid (*G*) *Hh*, which is green, and, in *F*<sub>2</sub> three hybrids (*G*) *HH*, (*G*) *Hh*, (*G*) *hh*, all of which have green cotyledons and seed coats (see Table III).

On the other hand, the cross *Yellow* ♀ × *Green* ♂, with the formula (*Y*) *hh* ♀ × (*G*) *HH* ♂, gives in *F*<sub>1</sub> individuals (*Y*) *Hh* with green seed coats, and in *F*<sub>2</sub>, 1/4 of the individuals (*Y*) *HH* green, 2/4 (*Y*) *Hh* green, and 1/4 *Yhh* yellow, as would be expected.

Table III shows the transmission of the characters "green" and "yellow". In each case *G* and *Y* are transmitted by the female plant only; thus, in the cross in the first column, the *F*<sub>1</sub> hybrid has the formula (*G*) *Hh* instead of *YGHh*. Similarly, in the cross in the second column the formula of the hybrid is (*Y*) *Hh* instead of *YGHh*. The factor *H*, however, is obviously contained in the nucleus and is also transmitted by the male plant, in accordance with the Mendelian law.

TABLE III. — *Transmission of the characters "Green" and "Yellow".*

<i>Parents</i> . . . . .	( <i>G</i> ) <i>HH</i> ♀ × ( <i>Y</i> ) <i>hh</i> ♂			( <i>Y</i> ) <i>hh</i> ♀ × ( <i>G</i> ) <i>HH</i> ♂		
Colour of cotyledons . . . .	green		yellow	yellow		green
Colour of seed coat . . . .	green		yellow	yellow		green
<i>F</i> <sub>1</sub> . . . . .	( <i>G</i> ) <i>Hh</i>			( <i>Y</i> ) <i>Hh</i>		
Colour of cotyledons . . . .	green			yellow		
Colour of seed coat . . . .	green			yellow		
<i>F</i> <sub>2</sub> . . . . .	( <i>G</i> ) <i>HH</i>	( <i>G</i> ) <i>Hh</i>	( <i>G</i> ) <i>hh</i>	( <i>Y</i> ) <i>HH</i>	( <i>Y</i> ) <i>Hh</i>	( <i>Y</i> ) <i>hh</i>
	25 %	50 %	25 %	25 %	50 %	25 %
Colour of cotyledons . . . .	green	green	green	yellow	yellow	yellow
Colour of seed coat . . . .	green	green	green	green	green	yellow

CONCLUSIONS. — The colour of the cotyledons is transmitted by the female plant only, and is due to two determinants, *G* and *Y*, contained in the cytoplasm of the egg-cell, and each subjected to the action of a third determinant, *H* contained both in the ovule and in the pollen grain, which has two effects on the seed coat: — 1) it modifies the intensity of the green colour, *G*; 2) it prevents plants containing *Y* from turning yellow.

The maternal inheritance described by the author seems to be identical with the character "*albo maculata*" studied by CORRENS in *Mirabilis Jalapa* (1) and by BAUR in *Antirrhinum majus* (2), which is only transmitted by the female plant.

637 - **Hybridisation Experiments between Different Varieties of the Cultivated and Wild Strawberry, in Alaska, U. S. A.** — *Annual Reports of the Alaska Agricultural Experiment Station* for the Years 1904-1915. Washington, 1905-1916.

Numerous hybridisation experiments were carried out from 1904 to 1915 at the Agricultural Station of Sitka, Alaska, with a view to obtaining a new type of strawberry combining the following characters: —

1) Resistance to winter cold and the capacity to ripen fruit regularly during the cold, damp summer of the coastal district.

2) Firm, slightly juicy fruit.

Both these characters are found in the wild Alaskan strawberry, *Fragaria chiloensis*.

3) High yield.

4) Large fruit.

These two qualities are characteristic of the cultivated varieties.

**ALASKAN WILD STRAWBERRY.** — *Fragaria chiloensis* is plentiful along the coast from Icy Strait to Prince William Sound, in the most sterile sandy soils, to which it has adapted itself so well that, when transplanted into richer soils, it produces abundant vegetation but no fruit. The leaves of this species are characterised by having a large number of leaflets, 4 on an average, sometimes even 5 or 6. Flowering begins during the first 10 days of June, 2 or 3 weeks earlier than the cultivated varieties. The first fruits appear at the beginning of July and the plant continues to bear fruit until very late in autumn. The fruit is of average size, conical shape, very delicate flavour, with firm, slightly juicy flesh, very resistant to packing and transport.

**CROSSINGS.** — The female parents were the cultivated varieties Enhance, Magoon, Bismark and Hollis. The last named, which may be a native of Michigan, has not as yet been identified and has received the name of the place from which it came last — Hollis, in Prince of Wales Island, Alaska.

The cultivated varieties, kept in greenhouses, so that they should flower at the same time as the native species, were first castrated then fertilised with pollen from *Fragaria chiloensis*. The  $F_1$  hybrids had the following characteristics: —

1) Vigorous, even excessive, growth.

2) Leaves similar to those of the native species, with 4 leaflets, but less well-developed blade, and longer and stronger petiole.

3) Earliness; resistance to unfavourable climatic conditions, but with very marked individual differences.

(1) CORRENS, C., *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. I, 1909, pp. 291-329; Vol. II, 1909, pp. 331-340. — (2) BAUR, E., *Ibid.*, Vol. IV, 1910, pp. 81-102.  
(Author).

4) Fruit as large as that of the parent Hollis, sometimes even larger, possessing at the same time the valuable characters of the native strawberry — firm, slightly juicy flesh, delicate flavour.

5) Shape of fruit varying from round to conical with all intermediate graduations; the pointed forms usually have a better flavour.

6) High productivity — more than 250 fruits per plant in the hybrids Nos. 1503, 537, 320.

The crossings, therefore, gave positive results, since it was possible to unite in one plant the valuable characters of both parents. The selection work is being continued with a view to isolating and fixing the most promising lines and thus create a good type of strawberry capable of being propagated throughout the coastal district of Alaska. It should be noted that the development of the blade and the size and number of the stomata make the new varieties absolutely incapable of resisting even a short drought and thus limit their being grown further south than a little beyond the 50 th parallel.

638 — **Acclimatisation, Selection and Hybridisation Experiments with Fruit Trees in Alaska, U. S. A.** — *Annual Reports of the Alaska Agricultural Experiment Stations for the Years 1904-1915.* Washington, 1905-1916.

The results are given of a series of acclimatisation, selection and hybridisation experiments, carried out from 1903 to 1915 at the Agricultural Station of Sitka, in order to obtain types of apple, plum and cherry trees capable of growing and bearing fruit in the coastal regions of south-east Alaska.

In the interior (Yukon Valley) experiments with arborescent Rosaceae gave absolutely negative results from the beginning; the summer, though relatively warm, is too short for the wood and fruit to ripen, and the very severe winter never allows the plant to hibernate. Sitka is on the west coast of Barabanov Island in N. latitude 57° 3' and W. longitude 135° 20' (Greenwich meridian), and its climatic conditions are totally different from those which are suitable for the regular development of fruit trees. The summer-autumn period, from the last destructive spring frost to the first autumn frost, is fairly long (from May to September), but wet and cool, thus having an inhibitory influence on the ripening of fruit and wood. The winter, though less severe than in the interior, is nevertheless very cold and kills and, to a certain extent, causes necrosis of the buds which form during the favourable season. The absence of a hot and dry period prevents the plant from developing resistance to low temperatures by loss of water and thickening of the cell walls. The experiments dealt with varieties of apple, plum, and cherry trees.

I. APPLE TREES. — 1) *Acclimatisation.* The plants used in the acclimatisation experiments may be divided into three groups: — a) *Pyrus baccata*, a native Siberian variety; b) certain varieties known in North America as crab-apples, probably derived from a cross between *P. Malus* and *P. baccata*; c) different varieties of *Pyrus Malus* cultivated in the cold districts and known for their resistance to low temperatures.

*Pyrus baccata*, from Siberia and Manchuria, was first planted at Brandon, Manitoba, in 1890, and spread rapidly through the cold and wet districts of north-western Canada, where it thrives and bears fruit regularly every year. It is a fine tree with a thick crown, smooth bark, compact wood and tasty, reddish-yellow fruit, about the size of a cherry (diameter = 18 mm.) At Sitka it gave good results. Four times from 1908 to 1914 the fruit formed in good time, *i. e.*, before the first autumn frost; both the fruit and the wood ripen fairly rapidly.

Although few data on the subject are available the dates of the principal vegetative phases may nevertheless be stated approximately: — 1) Leafing during the first 10 days of June; 2) flowering during the last 10 days of June; 3) complete maturity towards mid-October. The first fruit was obtained in 1911 from trees 8 years old, planted at Sitka in 1903.

*Pyrus baccata* × *P. Malus*. — As has already been said the varieties of crab-apples are probably a cross between the two species *baccata* and *Malus* rather than products of a pure selection of *P. baccata*. These trees have already given very satisfactory results in different parts of Canada, and the experiments in Alaska justified the hopes placed in them. Only a few of the numerous varieties imported from time to time into Sitka responded to acclimatisation, but the greater part of those which succeeded belonged to the crab-apple varieties. They were Whitney, Transcendent, Martha, Sylvan Sweet, Buir Sweet, Hyslop, Yellow Transparent, and Livland Raspberry. The two last hold first place. (The Report gives two photographs of Whitney and Livland Raspberry apple trees, with their fruit).

*Pyrus Malus*. — The varieties Duchess, Peerless, Wealthy, Tetofski, Keswick's Codlin and a few others are resistant to low temperatures and bear fruit, which, however, rarely ripens. In 1915 only, chiefly owing to the relatively warm September, all the above-mentioned varieties gave good yields, and the fruit ripened completely, but differed from fruit of warmer climates in its smaller size and longer, conical shape. Only summer varieties, ripening generally in the United States at the end of July or during the first 10 days of August, should be imported. None of the autumn varieties, although resistant to cold, can ripen early enough, *i. e.*, during the first 10 days of October at the latest. The approximate dates of the various phases of development are: *a*) growth of the wood-buds, towards mid-May; *b*) leafing during the first half of June; *c*) flowering during the second half of June; *d*) ripening during the first half of October; *e*) fall of leaves during the second half of October.

2) *Hybridisation*. — Along the Alaskan coast and near the sea, the native Alaskan Crab (*Pyrus rivularis* L.; a photograph of a branch is given) grows wild in dense thickets which are sometimes impassable. It rarely has a single stem, but usually a clump of shoots which branch out a few inches from their base and may reach a height of 18 to 22 feet, and a diameter of from 4 to 6 inches. The leaves are ovate-lanceolate with long petioles. The yellowish-red fruit, hardly bigger than a pea, looks like miniature apples, and has a very delicate taste and smell. It makes excellent jam. *Pyrus rivularis* flowers abundantly during the first days of June

(10 to 12 days earlier than the varieties under consideration) and ripens remarkably early, during the first days of October. As a rule the wood and new tissues attain a sufficient degree of ripeness and compactness each year to resist the winter cold.

The most important characters required are productivity, good quality fruit and resistance to adverse climatic conditions. An example of a satisfactory realisation of such factors is found in the wheat selected for southern Sweden. Crosses between the native varieties of Swedish wheat, early and resistant to cold, but with low yields, with the very productive, but late and slightly resistant English Squarehead varieties, gave hybrids uniting satisfactorily all the desired characters thus helping to increase considerably the grain yield of southern Sweden. Similarly it was thought that *Pyrus rivularis*, a native Alaskan apple, early and resistant, might be crossed with varieties of *P. Malus* with a view to increasing their resistance and also producing larger and better quality fruit.

So far the results of the experiments have been unsatisfactory. This is not surprising considering the bad state of preservation of the pollen used (collected in the United States from trees flowering 1 or 2 months before the Alaskan apple and sent by post). This difficulty has been overcome by using pollen from a resistant variety of *Pyrus Malus* flowering at Sitka almost at the same time as *P. rivularis*. The crosses were successful, but a large proportion of the fruit fell before fully ripe. A small quantity of seed obtained in 1914 was used, and positive results are hoped for eventually. It must be remembered that:— 1) certain varieties of *P. Malus* have succeeded, in favourable years, in ripening their fruit completely; 2) crosses with *P. baccata* have already produced very resistant types, with relatively large and well flavoured fruit. The greater part of the varieties crossed satisfactorily at Sitka and acclimatised there are crab-apples; 3) if, therefore, satisfactory results have been obtained with *P. baccata*, it is probable that *P. rivularis*, when the hybridisation has succeeded, will give yet better results. The hard varieties of *P. Malus*, the Siberian crab-apple (*P. baccata*), the hybrids *Malus* × *baccata*, the Alaskan apple (*P. rivularis*) supply material rich in varied characters, which, when suitably selected and combined, will probably lead to the formation of types specially adapted to the extreme northern districts.

II. PLUM TREES. — Numerous species and varieties of plum trees have been tested at the Sitka Experiment Station. Among them may be mentioned May Day, Tomahawk, Sayles, Wyant, Hawkeye, Forest Garden, De Lota, Rollingstone, Siont, Red June and Ait Kin, which flower during the first half of July, but do not bear fruit on account of the rain and damp which prevent setting. Varieties known for their resistance to cold obtained by HANSON in South Dakota for crossing with *Prunus Besseyi* Bailey, also gave absolutely negative results. In reality it is not the severe winter which prevents the growing of plums in south-west Alaska, but rather the heavy rains, absence of high summer temperature (see Table I), and the unfavourable weather conditions, which prevent the fruit from setting and the wood from ripening. The tissues which form in summer remain

turgid and without cohesion, and are destroyed every winter by temperatures which in other latitudes the plum could bear without suffering such serious damage.

In 1914 and 1915 a greengage produced ripe fruit in a garden at Sitka; the plant, however, had been grown on a trellis well protected from the wind. A hybrid from Koslov, obtained from the Botanical Garden of Chico, California, also promises well and good results are expected from varieties imported from northern Europe. Nevertheless, the results so far obtained must, on the whole, be considered as absolutely negative.

III. CHERRY TREE. — The varieties of sour cherry cultivated at Sitka flower profusely every year, but only a small proportion of the flowers (slightly more than 10 %) set. This is due to two causes:— 1) the summer rains and moisture which largely prevent normal setting; 2) the absence of pollinating insects. The little fruit which forms rarely ripens in good condition; rains and moisture crack the skin and cryptogamic diseases often attack the fruit and spoil it entirely. The 4 varieties, Early Richmond, English Morello, Ostheim and Dyehouse, planted in 1903, with the exception of the disadvantages already mentioned, stood the test well and began to bear fruit in the 5th year. The dates of the different stages of development are:— 1) leafing, first days of June; 2) flowering, on an average towards the end of June or the first days of July, with great annual variations. Thus, in 1909, English Morello began to flower towards June 15, but in 1908 towards July 15. The same applies to the other 3 varieties. In very cold and damp seasons flowering is slow and may continue till August, but, in this case, the fruit does not ripen, as was the case in 1907. Setting occurs between the 10th and 20th day after the beginning of flowering, but, as has been said, it is rare; in 1906 only, under exceptionally favourable climatic conditions, the percentage of fertile flowers reached 40 %.

*Ripening.* — The English Morello and Dyehouse varieties usually ripen towards August 12, Ostheim towards the 10th, and Early Richmond (of which the Report gives a photo), the earliest variety, towards the 8th.

*Duration of growing period and the various sub-periods.* — a) between the fall of the leaves, which occurs about October 15, to the leafing of the following season, there is a period of about 7 ½ months; b) there are, on an average, 30 days between leafing and flowering; c) in spite of the low temperature and great moisture, there are barely 40 to 45 days between flowering and ripening. In this case the first place is again held by Early Richmond, with a real record for earliness, 1 month (1); in 1908, flowering July 15, ripening August 15; in 1906, flowering July 1, ripening August 1; d) there is usually a little more than 2 months between ripening and the fall of the leaves. In order to compare the effect of meteorological factors on growth, Tables I and II reproduce the figures obtained at Sitka in 1906. Table I gives an idea of the peculiarities of the climate at Sitka during the formation and development of the fruit:— 1) heavy rains (July and August);

(1) In Italy an average of 71 days (Azzi, G., *Climatology and Phytogeography*, in *Rivista meteorico-agraria*, Year XXXVI, No. 33, p. 24. (Ed.)

2) relatively low average daily temperature (July; 10°C., whereas at Rampart, in the interior, it was 12.1°). In spite of that the first ripe fruit was obtained on August 1, so that the total average daily temperature during the 3rd sub-period of growth (from flowering to ripening) is a little over 3000° C. (3060°C.) (1).

CONCLUSIONS. — 1) *Plum trees*, results almost completely negative; the fruit and wood ripen in exceptional cases only; 2) *Cherry trees*, certain cultivated varieties of sour cherry may, without any morphological change, develop in the south-west of Alaska, limiting the duration of the 3rd sub-period to a minimum of one month, in spite of the damp and coolness of the coastal districts; 3) *Apple trees*, none of the cultivated varieties of *Pyrus malus* can be successfully imported, hybrids obtained from crosses with crab-apples give no regular annual crop, and only bear fruit every two years or more rarely. Nevertheless the wild Alaskan *P. rivularis* may be crossed with *P. malus*, and it is probable that, by a series of such crosses, the small fruit of the wild apple might be improved without decreasing the resistance which allows the tree to flower and bear fruit regularly each year. Alaska can certainly never become a fruit-producing country, but this in no way diminishes the great practical and scientific importance of these investigations, the results of which may be profitably applied in the high mountains and vast northern regions of America, Asia and Europe.

TABLE I. — *Meteorological data obtained at the Sitka Station, Alaska, during the period January-October, 1906.*

(These meteorological data should be compared with the data for the growth of the apple and plum trees given in the text).

	Temperature			Total rainfall in.	Number of days of				
	maximum	minimum	daily average		clear weather	uncertain weather	cloudy weather	rain or snow	
January . . . . .	48 °F	— °F	26.10 °F	7.25	11	1	19	12	
February . . . . .	50	22	37.28	1.89	16	3	9	6	
March . . . . .	55	21	39.03	1.58	17	3	11	6	
April . . . . .	59	31	41.93	10.63	3	10	17	25	
May . . . . .	75	31	47.82	3.46	7	11	13	15	
June . . . . .	65	34	55.39	3.34	11	10	11	16	
July . . . . .	69	40	54.91	7.45	9	1	19	15	
August . . . . .	65	43	54.79	4.66	9	3	19	16	
September . . . . .	66	33	52.35	5.78	6	4	20	20	
October . . . . .	65	34	46.57	15.22	1	6	24	25	

(1) In Italy the total average was 921° C., i. e., 3 times as large (Reference the same as in Note on p. 68.)



TABLE II. — *Data on the growth of varieties of cherry grown at Sitka in 1906.*

Variety	Leafing	Flowering	Setting	Ripening	Fall of leaves
English Morello. .	May 20	July 1	20 %	August 10	October 14
Early Richmond .	June 1	July 1	40 %	August 1	October 15
Ostheim . . . .	June 1	July 1	good	August 5	October 12
Dyehouse . . . .	June 1	July 1	good	August 5	October 12

639 — **The Germination and Purity of Seeds in Montana.** — ATKINSON, A., WHITLOCK, B. W. and JAHNKE, E. W. *University of Montana, Agricultural Experiment Station, Bulletin No. 113, Third Annual Report of the State Grain Laboratory of Montana*, pp. 79-100. Bozeman, Montana, December, 1916.

AGRICULTURAL  
SEEDS

The work of the Montana State Grain Laboratory during the year 1915-1916 consisted of: — 1) Purity and germination tests of 5 035 samples received; 2) a study of the seed value of frosted wheat; 3) a continuation of the study, begun in 1915, of hard seeds in clover samples; 4) a study of the germination of seeds at different periods after harvesting; 5) cooperation with the Association of Official Seed Analysts of America in studies on the standardization of grain laboratory methods; 6) a continuation of milling and baking studies of Montana wheat.

The two outstanding features of the year's work were a great increase in the number of samples sent for testing, and the very marked increase in the weed-seed content of alfalfa, clover, timothy and sweet clover. There is a tendency for the impurities in seed samples to increase each year; for example, in 1913-14 the average percentage of impurities was 5.91, in 1914-15 it was 6.32, and in 1915-16 it rose to 8.3. The purity of alfalfa and clover was higher in 1915-16 than in the two preceding years, but was still considerably below the standard. There is no doubt that there is an increased percentage of bad weeds in all crops, and, unless great care is taken to insure the use of clean seed, this increase may become very serious.

Numerous tests were made of the average germination of the principal grains and grass seeds grown. Maize, oats, barley and flax, had a somewhat lower average germination for the year 1915-16 than for 1914-15, though the decrease was of importance in maize only, the average germination of which was below 80 %, thus again showing the importance of carefully testing seed maize. The average germination of alfalfa and clover was satisfactory, very little of the seed falling below the Government standard. Many vegetable seeds were also tested and, except in the case of parsnips and carrots, the average germination quality was generally high.

To determine the value of frosted grain for seed, comparative field tests were made of the germinating capacity of frosted and unfrosted seed. The results given in Table I showed that frosted grain has a slightly lower field germination, but gives a greater number of heads per row and a higher yield.

Experiments with Marquis wheat have been carried out at the Experiment Stations of 13 States, from Iowa to Minnesota in the east to Oregon and California in the west. In this vast stretch of land the adaptation and value of the new variety vary with the local conditions. This part of the United States may be separated into four divisions according to the chief conditions of the districts ; 1) the northern Prairie or sub-humid zone, 2) the northern Great Plains or semi-arid zone ; 3) the western Basin and the Coast or arid zones, 4) the irrigated districts of the northern Rocky Mountain region and great Basin zone.

A. — VALUE IN THE SUB-HUMID ZONE. — Wherever possible winter wheat should be grown. Where spring wheat can be grown the Marquis variety may be recommended. The varieties of Fife, Bluestem, and Preston grown should not be hastily discarded ; the Marquis should be compared with these spring wheats and the best one chosen.

B. — VALUE IN THE SEMI-ARID ZONE. — 1) The winter varieties are best wherever they can be grown in the north of the Great Plains districts ; 2) durum wheats are better than any common spring wheats in this zone ; 3) Marquis is better than any other variety of common spring wheat in some parts of this zone and equal to any throughout the district. Where spring wheat is grown and durum is not used Marquis is a safe variety to cultivate.

C. — VALUE IN THE ARID ZONES. — The dry lands of the States west of the Rocky Mountains are included in the arid zones. Marquis wheat is not to be recommended for this district.

D. — VALUE IN THE IRRIGATED ZONES. — Marquis wheat has not yet been largely grown in the irrigated valleys of the western States. According to the information available it has given good results in western South Dakota and in Montana. In Idaho and Nevada the soft white spring wheats, such as Dicklow, Defiance, Palouse, Bluestem and Little Club all out yielded Marquis under irrigation.

MILLING VALUE. — Marquis is a first class wheat for flour making, being at least equal to Fife and Bluestem in this respect.

II. — The results obtained with Manitoba wheat in France and North Africa have exceeded all expectations ; it has proved to be a spring wheat suitable to all the districts of France, and in the south of this country, in Algeria and Morocco it seems capable of replacing winter wheat, Marquis wheat appears to have all the good qualities of this wheat without its defects.

Marquis wheat was studied by the author in the Paris district, at Grignon, and by M. SÉBASTIAN in the south of France, in the Bouches-du-Rhône. The results confirmed those of M. DE VILMORIN (1). — Marquis wheat proved earlier and more productive than Manitoba wheat. In M. SÉBASTIAN'S field it developed in 107 days, ripened 8 days before Manitoba and 12 days before Red Fife (the chief variety of the mixture of wheats forming Manitoba). It yielded 0.030 lb per square foot, whereas the two other varieties barely yielded 0.024 lb. per square foot.

(1) See *R.*, February 1918, No. 157. (*Ed.*)

642 - **The Origin, Characteristics, and Quality of Humpback Wheat.** — THOMAS, LEVI M. (Assistant in Charge of the United States Grain Standardization Laboratory at Fargo, N. Dak.), in *U. S. Department of Agriculture, Bulletin* No. 178, 4 pp + 1 Plates. Washington, D. C., December 30, 1916.

Humpback wheat is a bearded spring wheat characterized by a velvet chaff. It is being grown in increasing extent in Minnesota and to a limited extent in the Dakotas. This wheat has found favour with the producers because of the large yields claimed for it, but it is generally discriminated against by the grain trade because of its alleged inferior milling qualities.

This strain of wheat is said to be the result of a field selection by J. P. BERGLUND, a farmer living near Kensington, Minn., who about 18 years ago found, growing in a field of Bluestem wheat, a plant distinguished from the rest of the field by bearded heads and a more vigorous growth. The seed from this plant was planted separately, and produced a strain of wheat known as Humpback, which wheat was first distributed among the Kensington farmers 11 or 12 years ago. It was originally called Bearded Bluestem, a name given to it by Mr. BERGLUND because it has the characteristic velvety chaff of Bluestem, but it soon earned the more popular name of Humpback, owing to the peculiar shape of the kernels, the dorsal side being characterised by a prominence immediately to the rear of the germ and a curved slope toward the brush, making the term Humpback quite descriptive. The term Marvel, and perhaps other names, has been applied to this variety by distributors of the seed. This wheat should not be confused with the so-called Velvet Chaff wheats of the Northwest, which are bearded spring wheats of the Red Fife type and have a smooth chaff.

Humpback wheat has a large berry, somewhat soft in texture, giving a high yield of flour. The weight per bushel of this wheat is higher than that of Bluestem wheat.

The flour from the samples of Humpback wheat was lower in baking strength and general quality than the flour from the other spring wheats which were tested.

Milling and baking tests of Humpback wheats gave the following average results : — yield of straight flour, 71.2 per cent ; volume of loaf per 340 gm. of flour, 2145 cc. ; absorption (water used per 100 gm. of flour), 49.8 ; colour of crumb (score), 95.1 ; crude protein (N  $\times$  5.7) : in flour, 13.76 % ; in wheat, 14.35 %.

643 - **Plants Yielding Tannin, in India.** — See No. 699 of this *Review*

644 - **Venezuelan Production of Balata.** — BRETT, H., in *Commerce Reports*, No. 272, pp. 698-699. Washington, D. C., 1917.

Balata, a gum similar to gutta-percha, is largely used in the manufacture of belting. It is obtained from the sap of *Mimusops globosa* Gärtn., a tree reaching 100 feet or more in height, which is widely distributed over eastern Venezuela and the Guianas. The latex is secreted between the bark and the wood of the tree ; it contains nearly equal proportions of resin and gutta, the latter being identical with true gutta-percha.

PLANTS  
YIELDING  
TANNIN

RUBBER,  
GUM AND RESIN  
PLANTS.

The word "balata" is of Carib origin and is used by the natives of British, Dutch, and French Guiana as well as by those of Venezuela, but it is applied solely to the gum, the tree being known as the "purguo". On the coast between Puerto Cabello and Cape Codera the tree is called the "nisperillo".

The commercial exploitation of this tree in Venezuela began near Maturin, where by 1894 it had already been exterminated. Sap collecting was then begun near San Felix in the State of Bolivar and, as the tree became scarcer, the area of operations was extended eastward to the boundary of British Guiana and southward along the Orinoco and its tributaries to all accessible regions. In Venezuela the custom is to cut down the trees in order to obtain the sap, and the industry has thus been progressively destroying itself. A governmental commission estimates that in the last 10 years alone the 10 000 collectors have destroyed 36 000 000 "purguo" trees and that the direct loss to the nation from this cause amounts to more than half a billion dollars. In spite of the fact that in British and Dutch Guiana felling is prohibited and that regular production of latex is obtained by tappings that do not kill the trees, the merchants of Ciudad Bolivar have opposed any governmental prohibition of the cutting down of trees, arguing that in whatever manner the tree is cut it will die and that there is no better method of obtaining the latex than felling.

The "purguo" is of slow growth, the period required for a tree to reach the productive stage being more than 10 years and full development not being attained for 30 years or more. The fruits, being agreeable in taste, are nearly all eaten by wild animals, so that natural reproduction is slow. The trees usually grow at the foot of hills where the soil is fertile and moist but not waterlogged, always scattered among other species and never densely. Land on which there are 16 purguos to the acre is considered rich.

The balata harvest begins in May and ends in August, but in years of continuous rains work may be carried on at all times except when the tree is in flower, the sap being then so poor as not to be worth gathering. The collector leaves his camp at 5 a. m., fells the first tree he finds, and makes four cuts on each side of the fallen trunk, to each of which he attaches a tin receptacle to catch the flow of latex. Having worked two trees he returns to his camp about noon carrying the product of his toil in a bag waterproofed with the same sap. The contents of the bag are emptied into a large receptacle. On Saturday all the collection of the entire week is coagulated by cooking, and afterwards the gum is pressed in wooden moulds into slabs weighing from 50 to 100 lb.

Under present methods the average production per tree is 3 gallons of latex, producing 18 lb. of balata worth from 15 to 40 cents a pound. By tapping properly it is estimated that each tree would produce latex worth \$2 each year for 30 years or more.

For a number of years balata, ranking immediately after coffee and cocoa, was third in importance among Venezuelan exports. The amount

and value of the shipments (stated in metric tons of 2 204.6 pounds and in American currency) from 1905 to 1916 were: —

Year	Tons	\$	Year	Tons	\$
1905 . . . .	1 461	755 400	1911 . . . .	2 222	2 449 070
1906 . . . .	1 280	863 830	1912 . . . .	1 698	1 767 260
1907 . . . .	1 545	1 128 595	1913 . . . .	2 219	2 032 870
1908 . . . .	1 465	1 149 600	1914 . . . .	894	698 625
1909 . . . .	1 650	1 283 575	1915* . . . .	1 069	789 325
1910 . . . .	1 903	2 193 800	1916* (six months)	287	226 215

(\*) According to *Documentary Leaflets of the International Institute of Agriculture*, April 1918, the exports for 1915 and 1916 were 1027 and 623 metric tons respectively (*Ed*)

The war has caused great changes in the course of the trade in Venezuelan balata. During 1913 Germany led among the buyers of the gum on the Ciudad Bolivar market, France ranked second, the United States third, and Great Britain fourth. In 1914 the United States rose to first place, followed by France, Germany and Great Britain in the order named. In 1915 Great Britain occupied first place, the United States was second, and France was a poor third, Germany disappearing from the list. In January-June, 1916, Great Britain and the United States again ranked first and second, respectively and France and Germany were both missing from the list.

In 1906 the price of balata in Ciudad Bolivar reached the then high mark of 35 cents a lb.; the average price is between 14 and 21 cents. The best price in 1915 was 23.7 cents, but the latest official tariff of exportable products issued by the Ciudad Bolivar custom house fixed the official valuation of balata at 5 bolivares per kilo, or 43.8 cents per lb.

645 — The Nature of the Soil and Manuring as Factors Determining the Tendency of Beets to Bolt (Set Seed) the First Year (1). — MUNERATI, O. and ZAPPAROLI, T. V., in *Le Stazioni sperimentali agrarie italiane*, Vol. LI, Pt. 1-2, pp. 24-40 + 2 Diagrams + 2 Pl. Modena, 1918 (*Authors' summary*).

SUGAR CROPS

The observations and researches of various experimenters (PRASKOWETZ, HERZOG, HOLRRUNG, DEUTSCH, MONTE MARTINI) had already shown that the tendency of the beet to become annual is favoured by special external conditions, particularly by heavy applications of manures, especially organic ones, but no information was available derived from careful and systematic work. At the R. Stazione Sperimentale di Bieticoltura (Royal Beet-growing Station) the authors, after some preliminary work carried out between 1912-1914 (which shows that the phenomenon of "bolting" is certainly favoured by external conditions which place the plants in a condition to benefit from a copious supply of food material), started more rigorous and far-reaching experiments in 1916, both in the field and in boxes (DEHÉRAIN type), by varying the kind of soil and using, as well as various fertilisers, exaggerated quantities of farmyard manure, in order to reproduce the case, fairly common in practice, of badly spread farmyard manure or of heaps washed for a long period by the rain.

(1) See also R., May 1917, No. 427. (*Ed*.)

Sowing was carried out about a month before the usual time when the stoppages of growth take place that more or less usually cause the beet to bolt. Germination took place simultaneously in both manured plots and boxes and in those that received no fertiliser, but in the former, growth was naturally much better. Below are given the percentages of plants obtained:—

	Percentages of annual plants			
	Without manuring	With manure		
		Complete mineral	Organic	Complete organic and mineral
Plots of medium soil (naturally fertile). . .	23	50	51	55
Boxes with sandy soil. . . . .	1-2	15	25	29
Boxes with medium soil (naturally fertile). . .	11-15	24	48	40
Boxes with organic soil (peaty). . . . .	28-34	41	44	41

CONCLUSIONS:— 1) It is clearly shown that the nature of the soil and manuring influences the bolting of beets.

2) The soil has an influence all the more as its fertility and richness in organic matter are greater.

3) The manuring, whether chemical or chemical plus organic, caused a considerable increase in the percentage of annual plants.

4) With the same seed sown at the same time, the extremes in the number of plants that bolted varied from 1-2 % in sandy, unmanured soil, to 55 % in fertile, heavily-manured soil.

5) It is impossible to say whether the increase in soil temperature caused by a heavy dressing of farmyard manure, independently of the food material it contains, has any influence; in any case, the number of plants that set seed was considerable even in those plots and boxes that had only received a dressing of mineral manure.

6) It cannot be stated whether the organic, chemical, or mixed manuring causes an increase in the number of annual plants on account of the finer growth of the plants in the beginning, as the same tendency was shown even by weakly plants.

7) These observations confirm the necessity of considering *Beta vulgaris* as a facultative biennial and annual form (DE VRIES). It appears inexact to consider the setting of seed by the beet during the first year as a phenomenon of atavism.

646 — Experiments on the Cultivation of Sugar Beet in Sicily. — BORZI, A., in *Bollettino di Studi ed Informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 1-2, pp. 10-26. Palermo, 1917.

Sugar beets were first grown experimentally over 1 195 square yards of the Colonial Garden, and then by farmers who were supplied with seed from the Garden. The following varieties were tested:— Rich French white sugar variety (Fouquier d'Hérouel); improved white sugar, original selection A; improved white sugar, original selection B; Klein-Wanzleben. Sow-

ing was carried out in mid-January, and harvesting at the end of June. At the Colonial Garden a harvest equal to 14.33 tons per acre was obtained. The average percentage of sugar was 12.7, with a minimum of 11.45 and a maximum of 14.10. Taken as a whole the results showed that conditions favourable to growth may be obtained if the date of sowing is advanced by about 3 months so that the critical period during which the crop demands the maximum amount of water includes a good part of the winter and spring, and the vegetative period continues till the beginning of summer, when heat has an accelerating influence. By this means the economic utilisation of beet is rendered possible in Sicily as a rotation crop where cereals are grown.

647 — **Varieties of Strawberry (1) and Their Culture in Indiana, U. S. A.** — OSKAMP, J., under the direction of WOODBURY, C. G., in *Purdue University Agricultural Experiment Station*, Vol. XX, *Bulletin* No. 200, pp. 16 + 14 Figs., Indiana, July, 1917. HORTICULTURE

Using as basis the observations made on the trials carried out at the Lafayette Agricultural Experiment Station (Indiana), 32 comparatively new varieties of strawberry are described, brief mention being made of 16 which, amongst those previously described (*Bulletin* No. 154, *Purdue University Agricultural Experiment Station*), are most popular in Indiana. The list indicates the self-fertile flowers and the pistillate or imperfect blossoms. In planting pistillate sorts, a staminate flower should be set every four rows to ensure proper pollination. Forty-two of the varieties are midseason; 6 (Americus; Dewdrop; Pan American; Progressive; Superb; Productive) are autumnal; among them only the last one requires cross fertilisation; of the mid-season varieties, 33 (Baldwin's Pride; Baltimore; Barrymore; Chesapeake; Class A; Early Jersey Giant; Early Market; Early Ozack; Evening Star; Fuller; Gandy; Grand Marie; Helen Davis; Hub; Indiana; Joe Johnson; Late Jersey Giant; Lea; Manhattan; Missionary; Ohio Boy; Orem; Pearl; Posey; Rewastico; Senator Dunlap; Sons Prolific; St. Louis; Twilley; Warren; William Bell; Winner) are self-fertile and 9 (Anna; Bauer; Class B; Columbia; Haverland; Knaub No. 1; Knaub No. 6; Sample; Warfield) require cross fertilisation.

For each of the 32 comparatively new varieties, the name of the person or firm supplying the original plants is given.

648 — **Varieties and Cultivation of Raspberries, Blackberries, Gooseberries and Currants in Indiana, U. S. A.** — OSKAMP, J., under the direction of WOODBURY C. G. I. Varieties of blackberries and raspberries with notes on their care, *Purdue University, Agricultural Experiment Station, Bulletin* No. 201, Vol. XX, pp. 12 + 6 Figs. Lafayette, Ind., August, 1917. — II Gooseberries and currants, *Ibid.*, *Bulletin* No. 207, Vol. XX, pp. 11 + 10 Figs. Lafayette, August, 1917.

The author, taking as basis observations made during five years' experimental work at the Agricultural Station of Purdue University, Lafayette, describes 24 varieties of *blackberries*, the best of which are Agawam, Ancient Briton, Eldorado, Stones Hardy, Taylor; 9 varieties of *black raspberries*,

(1) As regards strawberry selection and variety tests see R. 1916, Nos. 408 and 748: R. 1917, Nos. 18, 322 and 637. (Ed.)

among which may be recommended Cumberland, Kansas, New Stone Fort, Plum Farmer; 15 varieties of *red raspberries*, the best of which are Cuthbert, Early King (King), Loudon; 17 varieties of *gooseberries*, specially recommending Downing, Houghton, Josselyn (American Red Jacket), Oregon Champion, Pearl; 14 varieties of *currants*, with special mention of North Star, Red Cross, Red Dutch, Wilder.

For each plant is given a short note on the method of cultivation and pruning, its enemies, diseases and methods of controlling them.

**FRUIT  
GROWING**

649 — **The Common Honey Bee as an Agent in Plum Pollination.** — HENDRICKSON, A. H., in the *College of Agriculture, Agricultural Experiment Station, University of California, Bulletin* No. 274, pp. 127-232, 2 Figs. Berkeley, December, 1916.

The experiments described, carried out in the Santa Clara Valley, forms part of a series undertaken to determine why, under certain conditions, some plums bear abundant crops and under other conditions bear light crops or none at all.

In a large orchard two pairs of adjacent French and Imperial plum trees, as nearly as possible of the same age and size, were enclosed in a tent of white mosquito net, so as to exclude all insects. In every other way the trees were under the same conditions as the other trees in the orchard. The tents were put up before any of the blossoms opened, and taken down when there was no longer any danger of outside pollination. As soon as 25 % of the blossoms had opened a hive of bees was placed under one tent, and kept there throughout the blossoming period (about 5 days.) The bees seemed to prefer the flowers of the French plum to those of the Imperial plum. The results are given in the following table.

Trees	No. of blossoms counted. April 11, 1916	No. of fruits matured. August 7, 1916	Percentage
French plum under tent with bees . . .	1 069	193	18.05
French plum under tent from which bees were excluded . . . . .	1 058	11	1.94
French plums, average orchard set . .	9 991	359	3.54
Imperial plum under tent with bees	1 060	18	1.89
Imperial plum under tent from which bees were excluded. . . . .	1 050	0	0
Imperial plum, average orchard set. .	2 180	157	7.20

It is seen that the French plum under the tent with the bees set a much higher percentage of fruit than the other trees. The light crop obtained from the Imperial plum under the tent with the bees is unaccounted for, and it is intended to carry out further experiments to determine the cause.

The results show the honey bee to be one of the most important factors in carrying pollen from one tree to another. The most satisfactory method of introducing bees into orchards has not yet been decided, but it seems as if the best results would be obtained by placing about one hive to



the acre during the blossoming period, after which the hives could be removed.

650 - The Selection and Acclimatisation of Fruit Trees in Alaska, U. S. A. — See No. 638 of this Review.

651 - Grafting Stock in Sicily: the Experimental and Demonstration Vineyards Attached to the Royal Nursery of American Vines at Marsala. — PAULSEN, F and MAGGIONI, N. in *Relazione sull'andamento del R. Vivaro di Viti Americane di Palermo*, pp. 42 + 5 Tables + 1 Map. Palermo, 1916. Abstract in *Le Progrès agricole et viticole*, Year XXXIV, No. 48, pp. 537-454. Montpellier, December 2, 1917.

VINE GR

The authors give the results of observations on grafting stock made by them in Sicily from 1907 to 1912. The hybrids obtained in the Palermo nursery were kept under observation for some time in the Luparello vineyard for parent plants and in the Rocazzo experimental vineyard, in deep, rather heavy loam, free from lime, and much infected by phylloxera. The hybrids which showed the best qualities were propagated and transferred to the experimental vineyards of the Marsala district (Vineyard of Casa Bianca, Spagnola, and Misilla) in order to study their resistance to lime and drought, their affinity for the various local stocks, some of which are the same as those of the province of Palermo, and their productivity as compared with that of these stocks. The authors' observations are not only of interest to vine-growers in Sicily, but also to those in Algeria and hot countries.

The resistance to chlorosis of the stock imported from France into Sicily is greater there than in their native country or Upper Italy. This is due to the very different climatic conditions, and chiefly to the difference in the distribution of rain in the southern and northern countries. In the northern countries rain usually falls during the period of vegetative growth, whereas in Sicily it falls during the winter rest, so that much less calcium carbonate is absorbed. Tolerance to this substance may also vary very greatly, by 20, 30 or 40 %. This influence of climate and the seasons is still more emphasised by the fact that rain water, unlike telluric water, always contains some carbonic acid which acts as a solvent on the calcium carbonate, thus greatly facilitating its absorption, and consequently, increasing its harmfulness.

According to the authors the high resistance of some vines to chlorosis depends on a selective faculty possessed within certain limits by the absorbing roots, which special environmental conditions, such as those mentioned above, can only decrease or increase.

Resistance to chlorosis is usually less in American vines than in native vines and their hybrids, and depends on the extent of the secretion of acid substances; those species and varieties with most acidity in the roots are least resistant to chlorosis and vice versa.

Moreover, this character is connected with the presence in the soil of certain substances such as iron and, it would appear, magnesia, which neutralise the injurious action of the calcium carbonate and are necessary to the formation of chlorophyll.

As regards *adaptation*, the authors noticed that certain Franco-American hybrids (Aramon  $\times$  Rupestris G. No. 1, and Mourvèdre  $\times$  Rupestris 1202) were subjected by the changes in environment to marked variations from the characters observed in France. Especially have they shown a rather low resistance to drought, by reason of a climate much warmer than that of their native country, particularly when grafted on plants such as Cataratto, Catanese, etc., which are not very drought resistant. They, therefore, require moist, deep, fertile, not over heavy soils, otherwise there is danger of their fading or dying after a few years.

These conditions are particularly indispensable to Aramon  $\times$  Rupestris G. No. 1, the more so because it is a very productive stock.

Berlandieri R. Nos. 1 and 2, and their hybrids 420 A, 157-II, 34 E. M., 17-37, 319 A., 301 A., 301 B. and 41 B. usually do very well whether grafted or ungrafted, and are very tolerant to lime, even when it is present in a very assimilable form, as in the Spagnola experiment field, more especially so considering the wetness of the soil. Those which proved most resistant to drought under the conditions considered were Berlandieri Nos. 1 and 2, 157-II, 34 E. M., 301 A. and B. and 41 B. Nos. 420 A., 17-37 and 219 A. showed weak growth, especially when grafted on Cataratto, whether in the Casa Bianca experiment field, in calcareous sandy loam, ferruginous, light, stony, shallow, but with a permeable sub-soil, in the demonstration vineyard of Casa Bianca, or that of Misilla, in soil not very different.

The most productive stock are, in decreasing order, Aramon  $\times$  Rupestris G. No. 1, Berlandieri R. Nos. 1 and 2, 34 E. M. and 41 B. Those which showed greatest uniformity in this respect were Berlandieri Nos. 1 and 2, 41 B., 34 E. M., and 157-II. Production with the different stocks was usually more uniform in dry than in wet years.

The *affinity* of all these stocks for the native vines usually proved excellent. Only in rare cases did the plants die through lack of affinity, as happened with Mourvèdre  $\times$  Rupestris and 420 A. grafted with Catanese in the Casa Bianca experiment field, but everywhere else its condition was normal.

Affinity does not depend only on the nature of the stock and the scion, or on their specific differences, but also on their individual differences and the functions they are called upon to fulfill as stock or scion.

To counteract fading due to lack of affinity it suffices to use a stock which is a good conductor and has strong tap roots. This removes, or at least greatly decreases the obstacle arising from pressure at the point of grafting, which if not the actual cause of the phenomenon, hinders at any rate the material exchange and the circulation of sap between the stock and the scion. As a rule it is best to use stock the functional capacities of which are superior to those of the scion, or to use as scion a native variety with limited requirements, the development and production of which are not excessive (e. g. Grillo), so that even if the symptoms characteristic of want of affinity do not disappear completely, they at least become much less serious and frequent than is usually the case.



There are marked differences in development and production according to the native varieties grafted.

Aramon  $\times$  Rupestris G. No. 1, for example, is killed by serious phylloxera lesions when grafted with Cataratto, but continues in very good condition with Pignatello, Damaschino, Grillo and Grecanico, in the same soil. This fact had been remarked previously and was confirmed at Misilla and Casa Bianca. Aramon  $\times$  Rupestris G. No. 9, however, shows no sign of fading under identical soil conditions, and is in an excellent state of vegetation in the experimental vineyards. The same may be said of No. 2, and these two stock may be compared with Rupestris du Lot..

Very serious wilting due to *bramble-leaf disease* occurred in the Spagnola vineyard on plants of Aramon  $\times$  Rupestris grafted with Pignatello (a variety very subject to the disease), and on those of Mourvèdre  $\times$  Rupestris grafted on to Catanese (also very subject) from the first year after planting. The cuttings, however, came from a suspected locality. Only material known to be free from disease should be used.

One of the most brilliant results of grafting is that *it has made it possible to grow outside their zone of adaptation certain vines which in the past required special conditions*. Thus, Catanese, which ungrafted only does well in moist deep soils, when grafted with Sicilian-American hybrids of the Casa Bianca vineyards, proved strong and productive, even in dry, stony shallow soil.

The growth and yield of Zibibbo and Pignatello in the Misilla and Casa Bianca vineyards are very different from when they were ungrafted under similar conditions.

Mourvèdre  $\times$  Rupestris, which in its natural state suffers much from drought, grafted with Grillo has a very fine vegetation, even in the dry soil of the Casa Bianca experiment field.

Finally, the really exceptional fertility of certain scions which have attained a productivity hitherto unknown in these soils must be noted. Among these should be mentioned Damaschino on Aramon  $\times$  Rupestris G. No. 1 in the Casa Bianca and Misilla vineyards, Cataratto and Grillo on Berlandieri  $\times$  Röss Nos. 1 and 2, in the Misilla and Spagnola vineyards, Periconne, Catanese and Grillo on 157-11 and 34 E. M., in the Misilla and Spagnola vineyards, and Cataratto, Pignatello and Grillo on 41 B. in the Casa Bianca and Spagnola vineyards.

This leads to other, more important considerations. It is known that in dry soils vines are very subject to great irregularities in yield because they respond more to the atmospheric variations of different years. In the case of well-chosen American vines, however, this occurs more rarely and to a slighter degree, because certain stock counteract the failings of the soil so as to make it comparable to moist soils of similar composition. It is, therefore, a great advantage of grafting and the new methods of vine cultivation that they have removed, at least to a great extent, the dangers arising from a crisis due to an excess or a failure in yield.

The system which has given the best results is that of cleft grafting, on account of the greater uniformity of development and the higher yield

(as average per stock and per surface unit) obtained. This is very marked when comparison is made between two demonstration vines at Casa Bianca, one of which had been cleft-grafted, and the other grafted in the vineyard. The same result is observed in the experiment field at Spagnola, where the rows planted with cleft-grafts were much more uniform and productive, and, in some cases (31 B. and Berlandieri Ress. No. 2) earlier, than those which were grafted in the vineyard.

English grafting in the vineyard is, moreover, insufficient to obtain uniform and regular rows without gaps. This makes it necessary to adopt other auxiliary systems of grafting, such as the English herbaceous graft and the flute graft, with which good results may be obtained by grafting in the vineyard, results which in many cases are not inferior to those obtained by cleft-grafting.

Among the hybrids obtained in Sicily and planted in the experimental vineyard of Casa Bianca, there are some which are really *remarkable and well worth propagating*, by reason of their vigour, their resistance to drought and lime, their affinity to the French vines, and their yield. Tests have shown the most satisfactory to be Paulsen Nos. 473, 509, 779, 1043, 1064, 1077, 1103, 1119, 1120, 1254, 1321, 1323, 1362, 1381, 1437, 1447, 1548, 1583, 1837, 1901, 1902, and Ruggeri Nos. 48, 70, 77, 110, 128, 140, 143, 152, 162, 180, 198, 252, 253, 298, 300.

The greatest affinity was found among the Paulsen hybrids, Sicilian-American or  $\frac{3}{4}$  American, all of which are excellent from this point of view, with the exception of a few in which the authors noted cases of "folletage" (apoplexy).

The Ruggeri hybrids, nearly all Americo-Americans have not, as a rule, given good results with Catanese, a plant already known for its slight affinity for American vines and their hybrids. This seems to support the hypothesis that Vinifera hybrids have a greater affinity for French vines than pure American ones.

On the other hand there are among the old Franco-American stock many examples which prove the contrary. Thus Mourvèdre  $\times$  Rupestris 1202, Colombeau  $\times$  Rupestris (Gamay Coudere), Bourrisqou  $\times$  Rupestris, Aramon  $\times$  Rupestris G. No. 2 and No. 9, to mention only the principal ones, and a large number of direct hybrid bearers, have often shown a lesser affinity for French vines than many Americo-Americans. Also Grimaldi 188 (Calabrese  $\times$  Rupestris), when grafted with Catanese, dies in the third or fourth year. Other Sicilian  $\times$  American hybrids which, during the first years after grafting appeared very strong, suddenly died after from "folletage" in the Casa Bianca experimental vineyard. Death by "folletage" is but a particular case of lack of affinity.

The hypothesis laid down after a study of "folletage" in France (according to which the disease is caused by the action of strong dry winds over a prolonged period thus causing excessive transpiration by the leaves as compared with the amount of water absorbed by the soil) is in no way justified. The authors' observations show that the hybrids obtained and selected in Sicily usually have a greater affinity to Sicilian

vines than have the old stocks, besides being extremely resistant to drought. This is very promising for vine-growing in this district, for which, in view of its almost tropical climate, the investigations described are of the greatest importance.

It is still necessary to select these vines further for resistance to bramble-leaf disease, in order to choose stock possessing to a high degree the quality of adapting themselves to local conditions as well as all the other characteristic good qualities, so that the vines may become continually more profitable. In other words, it is necessary to choose the stock which is most satisfactory in all respects and will prove most valuable to Sicilian vinegrowers.

652 - Humification and Nitrification in Forest Soils. — Sec No. 624 of this *Review*.

FOREST

## LIVE STOCK AND BREEDING.

653 - Studies in Forage Poisoning (1). — GRAHAM, R.; BRUECKNER, A. L. and PONTIUS, R. L. I. — A Preliminary Report on an Anaerobic Bacillus of Etiologic Significance. *University of Kentucky, Agricultural Experiment Station, Bulletin No 207*, pp. 49-113. 36 Figs. II. — An Anaerobic Organism Isolated from Ensilage of Etiologic Significance. *Ibid.*, *Bulletin No. 208*, pp. 117-133, 7 Figs. Lexington, Ky., June and July, 1917.

HYGIE

I. — Forage poisoning has long been known in the United States, where it has caused serious loss in cattle, but more particularly in horses and mules. Previous experiments have already proved that *B. botulinus*, which causes botulism or meat poisoning in man, is pathogenic to horses and donkeys, producing symptoms closely resembling those of forage poisoning. The authors were able to confirm these results by experiments with horses and mules. In very acute cases the animals died without showing any previous symptoms, but, as a rule, the characteristics of the disease were loss of appetite, stupor, rapid breathing, subnormal or normal temperature, paralysis of the tongue and pharynx, salivation, slight watery discharge from nostrils, difficulty in feeding, muscular weakness, obstinate constipation, incoordination in walking, decumbency, decubitic ulcers accompanied by secondary infection, rapid horizontal movement of the fore feet as in running, intervals of coma until death. The incubation period may last from a few hours to a few days. Guinea-pigs are also very susceptible to infection by *B. botulinus*. Chickens are highly resistant, but it is interesting to note that the faeces of chickens fed *B. botulinus* are capable of infecting horses and mules given food contaminated with these faeces. This shows that fowls may be a factor in spreading the disease.

In order to study this question more fully further experiments were made with oat hay which had caused an outbreak of forage poisoning in 1915. The pathogenic factor in this hay proved to be water-soluble, and, after the forage had been stored for 22 months, fatally infected a horse which was given water in which it had been immersed. From the caecum of the

(1) See also R. November, 1917, No. 1032. (*Ed.*)

horse was isolated an anaerobic organism which was slightly motile, spore-forming, Gram positive and easily stained with the ordinary aniline dyes; the bacilli were single, but may occur in short chains. In its morphological characters this organism closely resembled *B. botulinus*.

The bacillus isolated from the caecum of the horse, when administered by the mouth, proved fatal to horses, mules, and guinea-pigs, causing symptoms indistinguishable from those caused by *B. botulinus*.

A thorough examination of the oat hay water in question led to the isolation of an organism which resembled closely that isolated from the caecum of the fatally infected horse; this organism, when administered by the mouth, caused death in horses, mules, and guinea-pigs, accompanied by symptoms identical with those caused by *B. botulinus*.

Antitoxic goat, sheep and cow sera, prepared against *B. botulinus*, proved efficacious against lethal amounts of a homologous toxin. The antitoxic serum afforded protection in horses when administered subcutaneously and intravenously, and in guinea pigs when administered intraperitoneally, against: 1) a fatal amount of homologous toxin by the mouth; 2) infection by the mouth with a lethal amount of the organism isolated from the caecum of the horse and against lethal amounts of the broth culture filtrate of this organism; 3) the bacilli isolated from the oat hay water.

The whole series of experiments seems to prove that *B. botulinus*, which is known to be capable of developing in forage, is the pathogenic agent in forage poisoning.

II.—Further experiments carried out on a farm, where there had been a natural outbreak of forage poisoning among mules, confirmed the results previously obtained. Agglutination tests with serum highly immune to *B. botulinus* and the organism isolated from the ensilage which caused the outbreak were positive, but normal sera of different animals agglutinated neither of the organisms. Sheep and horse sera immune to the organism isolated from the ensilage gave positive agglutination results with *B. botulinus* and the pathogenic organism isolated from the horse which died as a result of drinking water from infected oat hay.

654 — The Toxic Action of *Thlaspi alliaceum* and the Active Principles of Some Poisonous or Suspected Cruciferae. — BEGUINOT, AUGUSTO, in *Atti dell'Accademia Veneto-Trentino-Istrian*, Vol. X, pp. 90-110 Padua, 1917

In May, 1917, the author (Director of the Royal Garden of the Botanical Institute of Padua) examined some fresh fodder cut at Pettorazza (province of Rovigo). It had been asked whether such fodder could have caused the death of oxen (8 out of about 40 which had shown signs of poisoning) on a farm at Pettorazza. The author noted that the fodder consisted largely of the Crucifer *Thlaspi alliaceum* L., in an advanced stage of fructification, most of the seed being ripe.

Cruciferae cannot be considered as poisonous in the strict sense of the word, *i. e.*, capable of causing poisoning, fatal even in small amounts and at any period of development, but some can cause serious illness, often even followed by death, when eaten by cattle in large quantities during the advanced flowering stage or when ripe. The species most commonly held to

be dangerous are: *Brassica nigra* Koch, *Br. Sinapistrum* Boiss., *Br. campestris*  $\alpha$  *pleifera* D. C., *Eruca sativa* Mill, *Lepidium Draba* L., *Erysimum cheiranthoides* L., etc.

*Thlaspi alliaceum* is fairly rare in Italy, and very rare in Venetia. Neither this variety nor *Thl. arvense* should be given to cattle; when cows eat it their milk assumes a disagreeable garlicky smell. On the Pettorazza farm mentioned above the first fatal case occurred 5 or 6 hours after the last meal, the other cases after about 20 hours. The oxen were from 9 to 15 months old. The clinical symptoms were convulsions, shivering, weakness, etc. An examination of the blood showed the absence of pathogenic microorganisms. The post-mortem showed effects different from those generally observed in the case of poisoning in that the breathing tubes and stomach were very slightly affected. According to the author this is due to the rapidity with which the blood absorbs the poison (allyl sulphocyanate) thus causing death before the pathogenic effects could manifest themselves.

As in the Rovigo province the district infested with *Thl. alliaceum* is limited by the lower course of the Adige and the Bianco canal, the author believes it would be possible to exterminate the plant completely by a systematic destruction before the seed are ripe.

- 655 - Researches on the Malady "Trembles" or "Milk Sickness", Caused by *Eupatorium ageratoides* in North Carolina, U. S. A. (1). — CURTIS, R. S. and WOLF, F. A., in the *Journal of Agricultural Research*, Vol. IX, No. 11, pp. 397-404 + 2 Figs. Washington, June 1, 1917. — WOLF, F. A., CURTIS R. S., KAUPP, B. F. (Agricultural Experiment Station of North Carolina), in the *Journal of the American Veterinary Medical Association*, Vol. LII, New Series, Vol. V, No. 7, pp. 820-827 + 2 Figs. Ithaca, N. Y., March, 1918.

Of late years the authors' attention has been directed to a serious disease of domestic animals, including horses, cattle, sheep and hogs, which is commonly called trembles. This disease is transmissible to man through the milk of animals affected with trembles, and thus physicians call it "milk sickness". It has been known to be endemic in Tennessee, Kentucky, Ohio, Indiana, Illinois, Missouri and Georgia, since their first settlement and in North Carolina since the American Revolution. It was first described in 1810, but there is considerable confusion as regards the etiology of the disease, the etiological factors usually considered being 1) poisonous minerals (arsenic, copper, mercury, cobalt, lead, and aluminium); 3) a microorganism (*Bacillus lactimorbi*); and 3) a poisonous plant. The first 2 theories are not well supported by facts, whilst the third has 2 important points in its favour: - a) the malady disappears when the natural vegetation is replaced by cultivated plants; b) it is limited to the grazing season. A number of species of plants have been considered as causing "trembles", *Eupatorium ageratoides* (= *urticaefolium*) being most commonly held to be the cause.

Work published by MOSELEY, in 1906, confirms the opinion, held since 1840, that this plant, known as "white snake root", is the cause of the disease. The authors have adduced further proof by obtaining the disease in sheep, pigs, and guinea pigs fed with concentrated foods and white snake root.

(1) See also R., February, 1918, No. 179. (Ed.)

The symptoms include : — nervous spasms followed by paralysis of the limbs ; congestion of the brain, liver, heart and kidneys ; hyperaemia of the lungs ; mucoenteritis.

The incubation period of the disease varies from 3 days to 12 weeks or more ; the period between the appearance of the symptoms and the death of the animal (only a small proportion recovers) is from 12 hours to 3 or 4 days.

There is no certain method of treatment ; the only preventive measure consists in ploughing the areas infested by *E. ageratoides*, which is a perennial, and sowing them to cultivated forage plants. Timber land infested with the plant, and which cannot be ploughed up, should be fenced in, to keep the stock out.

Mr. MOSELEY's work is confirmed by the authors' experiments with sheep fed on green " white snake root " plants from June to October, 1916. Out of 18 experimental animals, 15 showed signs of trembles, while 14 died and 1 recovered. It is possible that one of the fatal cases was due in part to an infestation of stomach worms. Death ensued from 5 to 27 days after the animals had commenced to eat white snake root. Considerable variation existed in the several ewes, also, with reference to the quantity of weed ingested before trembles appeared. Indirect evidence against the infectious nature of the disease was secured by failure to communicate trembles from sheep characteristically affected to healthy sheep when they were confined and fed together in a small lot. Common stock salt (8 oz. and 12 oz. per head in 11 and 18 days) and baking soda (30 oz. per head in 19 days) given together with a mixed ration of *E. ageratoides* and grain were without apparent antidotal effect.

It has been claimed that aluminium phosphate causes a disorder similar to that following the feeding of white snake root, but the authors found no harmful effect to follow the feeding for 69 days of aluminium phosphate mixed with grain and supplemented with alfalfa hay.

656 — **Investigations on the Etiology and Control of Infectious Abortion in Mares, in Kentucky, U. S. A.** — GOOD, E. S. and SMITH, W. V., in *Kentucky Agricultural Experiment Station, University of Kentucky, Bulletin* No. 204, pp. 337-395 + 18 Tables, Bibliography of 29 works, + 13 Pl. Lexington, 1916.

In 1907 the Department of Animal Husbandry of the University of Kentucky equipped a bacteriological laboratory for the study of infectious abortion in cows and mares at the Kentucky Agricultural Experiment Station. At that time it was generally supposed that this disease in both these species of animal was caused by the same organism. Furthermore, the fact had not been established that the organism causing abortion abroad and in the United States was the same.

In 1896, Dr. BANG isolated *Bacillus abortus*, an organism now conceded to be the cause of abortion in the cow. Although he never isolated the organism from an aborting mare, he produced cases of abortion in mares experimentally by infecting them with the bacillus and concluded that the bacillus caused the disease in the mare as well as in the cow.

In 1911, the Kentucky Laboratory isolated *Bacillus abortus* Bang from aborting cows. At the same time, a number of cases of abortion in



mares were examined, but no causal organism could be found. The cause of the disease in cows being well established, the Laboratory concentrated its efforts on isolating the germ causing abortion in the mare, and succeeding in isolating a microorganism called *Bacillus abortivo-equinus* from the uterine exudates and foetuses of aborting mares. The experiments described in the Bulletin in question prove that this bacillus is the causal agent of abortion in mares.

During the experiments numerous studs and cases were investigated by the Laboratory, and studies were made regarding: — the morphological, cultural and physiological characteristics of the bacillus; the agglutination and complement fixation tests; inoculation experiments; the production of a hyperimmune serum; immunization tests with a bacterin made from *Bacillus abortivo-equinus*; the effect of methylene blue, hexamethyleneamine, carbolic acid, and potassium permanganate on the organism.

RESULTS OF THE EXPERIMENTS. — In confirmation of their previous experiments, the authors continue to find a bacillus belonging to Subgroup II of the *Colon-typhi* group as the etiological factor of infectious abortion in mares and jennets; they propose the name of *Bacillus abortivo-equinus* for the organism.

By cultural, agglutination and complement fixation tests, the organism is found not to be identical with other pathogenic organisms of Subgroup II of the *Colon-typhi* group, such as *Bacillus suispestifer*, *B. paratyphosus A*, *B. paratyphosus B*, *B. paracolon*, *B. enteritidis* Gaertner and *B. typhi-murium*.

The *Bacillus abortivo-equinus* varies in its physiological property of splitting lactose and saccharose, for it produced approximately 2 % of gas and 2.5 % of acid in 1 % lactose broth in 86 % of 116 trials and no gas in 20 % of these trials, while in 1 % of saccharose broth slightly less than 2 % of gas and about 0.2 % of acid were produced in 50 % of 56 trials, and no gas with this sugar in 50 % of the trials. It was found that *Bacillus enteritidis* Gaertner, belonging to the same subgroup of the *colon-typhi* group as *B. abortivo-equinus*, contrary to the generally accepted literature, produced 2 % gas in lactose in 75 % of the trials and in saccharose broth a small amount of gas was produced in 1 out of 7 trials.

The disease of infectious abortion in mares may be diagnosed by the isolation of *Bacillus abortivo-equinus* and by the agglutination and complement fixation tests.

A one-tenth of 1 % solution of potassium permanganate destroys *B. abortivo-equinus* in 1 minute. A 1 % solution of carbolic acid also destroys it in 1 minute. A 1 per 1000 solution of methylene blue destroys the organism in 5 minutes, while a saturated solution of boric acid destroys the germ in 3 hours. All these solutions in the strengths mentioned can be used as douches and not injure the mare. The water used should first be boiled, the chemicals added and cooled to body temperature before injection.

Subcutaneous injections of *B. abortivo-equinus* produced abortion in guinea pigs and rabbits, and an intravenous injection of the organism produced abortion in the hog and sheep. The feeding of large amounts of the

germ to a pregnant sow produced no injury whatever, and the subcutaneous injection, also the feeding of the organism to pregnant ewes did not produce abortion.

The intravenous injection of small amounts of the bacillus in hogs resulted only in lassitude for a few days, while a large dose given intravenously and repeated produced death, with the recovery of the organism from the internal organs of the animal.

An intravenous injection of 2 cc. of physiological salt suspension of *B. abortivo-equinus* in a pregnant mare produced abortion in 10 days, and the organism was recovered from the uterine exudate of the aborting mare and from the internal organs of the foetus. An injection of 1 cc. produced abortion in 12 days.

The growth of *B. abortivo-equinus* on large agar tubes flooded with sterile water, mixed with grain and fed to a pregnant mare produced a persistent diarrhoea which would not yield to medical treatment, resulting in the death of the mare 20 days after. Streak dilutions made of the internal organs of the mare and foetus on plain agar revealed the presence of *B. abortivo-equinus* in the heart blood of the mare and liver of the foetus, thus showing that the bacillus had passed through the intestinal walls to the blood stream of the mare and foetus and would have caused abortion had the mare lived.

A bacterin made by growing the organism on plain agar, flooded with physiological salt solution and heated to 60°C. for 2 hours protected rabbits against 10 times the lethal dose of the organism.

The subcutaneous injection of quite large doses of bacterin (killed organism), in pregnant mares, produced no ill effects, save an occasional abscess at the seat of inoculation. The injected mares produced live, healthy colts.

A mare receiving a bacterin in increasing doses, subcutaneously, and afterwards injected subcutaneously with increasing doses of the live organism, delivered a live, weak colt which soon developed into a strong individual. The treatment greatly depressed the mare. Soon after delivering the foal she began to mend, and, 4 months after, was in excellent condition. It is quite probable that the treatment with a bacterin had protected her from aborting when later quite large doses of the live organism were injected subcutaneously.

Increasing doses of a bacterin, followed by an intravenous injection of 2 cc. of a suspension of the live organism in physiological salt solution did not give a pregnant mare sufficient protection to deliver a healthy foal. While the colt came alive, it was a "sleeper" and died 22 hours after delivery.

A hyperimmune serum for infectious abortion in mares was produced that had marked bacteriolytic properties in vitro. This serum protected rabbits from the lethal dose of the organism. In one case, it protected from 5 times the lethal dose. The serum did not protect a mare from an artificial infection, the mare aborting 12 days after receiving the live organism intravenously. The amount of the germ given, however, was vastly

in excess of an infection which could have been obtained naturally. The serum may prove of value in a stud where infection is known to exist.

From these investigations it is concluded that a bacterin made of *B. abortivo-equinus* injected subcutaneously will, if given to a pregnant mare in proper and increasing doses, do no harm and will, in all probability immunise her against the disease of infectious abortion if the bacterin be administered before the disease is contracted in a natural manner. In the production of this bacterin, the bacillus is grown on agar slants and the culture then washed 3 times with normal salt solution in a centrifuge.

657 - **The Amino-Acid Minimum for Maintenance and Growth, as Exemplified by Further Experiments with Lysine and Tryptophane.** — OSBORNE, THOMAS B. and MENDEL, LAFAYETTE B. with the Cooperation of FERRY, EDNA L. and WAKEMAN, ALFRED J. (Laboratory of the Connecticut Agricultural Experiment Station and the Sheffield Laboratory of Physiological Chemistry in Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXV, No. 1, pp. 1-12, 14 Diagr. Baltimore, Md., May, 1916.

FEEDS  
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FEEDING

Additional experiments are reported in this paper to show the part played by tryptophane and lysine in the metabolism of maintenance and growth. The quantity of these amino-acids available in the diet can be made the limiting factors which determine the nutritive equilibrium and possibilities for increment of size in an individual. They afford an important illustration of the "law of minimum" applied to essential nitrogenous components of the food supply.

658 - **The Effect of the Amino-Acid Content of the Diet on the Growth of Chickens (1).** — OSBORNE, THOMAS, B. and MENDEL, LAFAYETTE B. (Laboratory of the Connecticut Agricultural Experiment Station and the Sheffield Laboratory of Physiological Chemistry in Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 2, pp. 293-300 + 1 Plate. Baltimore, Md., September, 1916.

Experiments on the feeding of albino rats have shown that for adequate growth a suitable supply of certain amino-acids must be available in the diet. Conspicuous among them are tryptophane, lysine and cystine. A ration which fails to yield these in reasonable abundance cannot promote growth but, if the other (non-protein) dietary factors are suitable, increment of weight can promptly be brought about by the addition of these essential amino-acids. BUCKNER, NOLLAU, and KASTLE have attempted to test the validity of the conclusions just expressed, in a series of feeding experiments on young chicks, by using grain mixtures which they believed to exhibit a low and high lysine content respectively. The outcome was interesting in showing unmistakable differences in the growth of the birds in the two groups.

Believing that the conclusion of BUCKNER, NOLLAU and KASTLE in respect to the relative amounts of lysine yielded by their foods was in the main correct, although unproved, the authors have concluded to attempt the application to the chick of the methods of feeding mixtures of more definitely known lysine content. The plan of the experiments was to compare the growth of chicks (Rhode Island Reds) fed on diets which, in one case contained "corn gluten", the mixed proteins of which yield about 1 per cent of lysine, and in the other case contained equal parts of "corn gluten"

(1) See also R., April 1918, No. 442. (Ed.)

and lactalbumin, a protein yielding about 10 per cent of lysine. The food mixtures contained, aside from the protein ingredients the essential substances including inorganic salts, fat-soluble and water-soluble hormones, which experience with rats has shown to be required for perfect growth.

Two types of food were employed. One, the "fat food", was made in the form of a paste by grinding the ingredients together with a sufficient quantity of lard and butter fat; the other, the "starch food", was made in the form of a coarse meal by substituting starch for a large proportion of the fat in the "fat food". In one experiment the total gain of body weight in 55 days was 52 gm. for the chick on corn gluten food; 283 gm. for the chick on corn gluten + lactalbumin food; in another a chick at the age of 81 days had gained 322 gm. in a period of 53 days, on the corn gluten + cottonseed flour ration, while at the same age a chick on the corn gluten food had increased in weight only 44 gm.

These results are in agreement with the writers' observations upon rats receiving similar diets. We thus see that corn gluten permits a very slight growth of chickens as well as of rats, because it contains some maize gluten — a protein which yields tryptophane as well as a little lysine. With chicks, as with rats, lactalbumin, rich in both tryptophane and lysine, is an efficient adjuvant to the proteins of corn gluten.

Therefore these observations corroborate, for the chick, the experience which the authors have previously published regarding the unlike value of different proteins in the nutrition of growth.

In further accord with the observations on the growth of rats, cottonseed flour also forms a suitable adjuvant for the proteins of corn gluten, whereby in the presence of "protein-free milk", butter fat, etc., satisfactory increments of growth can be obtained. Two chicks beginning at the age of 28 days on a corn gluten + cottonseed flour ration gained 450 gm. and 556 gm. respectively in 79 days.

The results confirm the conclusions drawn by BUCKNER, NOLLAU, and KASTLE respecting the effect of foods high and low in lysine on the growth of chickens. The assumption is justified that chickens, as well as rats, require a sufficient amount of lysine in order to make normal growth and that will doubtless be found true for other species.

659 — **Studies on the Nutritive Deficiencies of Wheat and Grain Mixtures and the Pathological Conditions produced in Swine by their Use.** — HART, E. B., MILLER, W. S. and MC COLLUM E. V. (Departments of Agricultural Chemistry and Anatomy of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXV, No. 2, pp. 239-259. 9 Diagr. + 5 Plates. Baltimore, Md., June, 1916.

In earlier studies on the influence of restricted natural feeds on growth and reproduction it was observed that a ration from the wheat plant — wheat grain plus wheat straw — was wholly inadequate with heifers for reproduction and in some instances for continued growth. With swine, confined to the wheat grain and a suitable salt mixture, growth soon ceased and the animals passed into a poor condition, while a maize and salt mixture ration was at least sufficient for slow growth and continued well-being. Similar results are on record with rats, and only when a liberal supply of

casein and fat-soluble *A* was added to a wheat grain and salt mixture was growth continuous and, in the case of rats, reproduction possible.

In earlier papers the authors have expressed the view of the possibility of inherent toxicity in the wheat kernel, a view now made probable by the fact that the wheat embryo yields by ether extraction an oil of distinct toxicity and a residue far more innocuous than the embryo itself. That this embryo carries a considerable quantity of a toxic substance is further shown by the fact that, on increasing the mass of embryo in the rations of herbivora, earlier abortions are produced than when the ration carries the whole wheat grain only. When the diet of swine consisted of whole wheat gluten plus a suitable salt mixture the individual soon failed to grow and passed into a pathological condition. Loss of weight, rough coat, emaciation, lack of muscle coordination, laboured breathing, and even blindness manifested themselves. Experiments with rats showed that with abundance of better proteins from milk powder or casein, a more efficient salt mixture and the addition of fat-soluble *A*, and with whole wheat constituting approximately 65 per cent of the ration, the depressing action of this toxicity could be overcome.

With swine receiving similar additions to the wheat grain, but not in the same quantitative order, growth was normal but reproduction failed. It is important in this connection to call attention to the fact that when the additions to wheat were only salts and butter fat but without casein, the curve of growth was improved, but ultimately these animals failed with symptoms similar to those shown on the wheat, salt mixture diet. It became evident as this work with swine progressed that these pathological conditions manifested by swine are, as far as the histological picture of the spinal cord is concerned, analogous to, if not identical with, the pathological condition recorded for polyneuritis in fowls, but here induced by an inherent toxicity and not by a deficiency. Therefore malnutrition, histologically characterized by nerve degeneration, may result from the absence of certain factors in the diet as in the case of beri-beri. A similar condition may likewise arise from the presence of toxic materials in apparently normal food products, and in the presence of all known factors essential for continued growth and well-being.

With a large mass of wheat in the ration of swine toxicity will follow even in presence of all the recognized factors for growth. Only in the presence of very liberal quantities of all these factors can the effect of the toxicity be overcome. No one important factor for growth, such as better proteins, salts, or fat-soluble *A*, appears able to act as a complete corrective for this toxicity.

It also appears possible to produce similar pathological conditions in swine in the absence of all known toxic material and in the presence of a fair quality of protein, a plentiful supply of fat-soluble *A*, and water-soluble *B*, but a poor salt mixture; namely, that natural to the grains used.

Excellent supplementary materials to the grains even in the presence of the toxicity of the wheat products, have been found in alfalfa and commercial meat scraps. Probably milk, if used in sufficient quantity, would

also serve this purpose admirably. The factors introduced by alfalfa are undoubtedly an abundance of fat-soluble A and a better salt mixture. Its richness in calcium may be important. With commercial meat scraps the factors for improvement are undoubtedly better proteins, more fat-soluble A, and a liberal supply of calcium phosphate resident in the bone material it carries.

660 — **The Stability of the Growth Promoting Substance in Butter-Fat.** — OSBORNE, THOMAS B. and MENDEL, LAFAYETTE B. with the cooperation of FERRY, EDNA L. and WAKEMAN, ALFRED J. (Connecticut Agricultural Experiment Station and Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXIV, No. 1, pp. 37-39. Baltimore, Md., 1916.

A considerable number of observations are now on record to show that certain mixtures of isolated food substances furnishing a ration upon which animals (albino rats) decline or cease to grow can be converted by the addition of some of the natural "fats" into a ration adequate for growth. The authors have found that the inefficiency of lard and some other fats in this respect is not due to the destruction of the growth promoting factor by heat, since these fats fail to promote growth adequately even when they are prepared at low temperatures in the laboratory. Furthermore they found that butter fat does not lose its growth-promoting potency by treatment with live steam; and the yolk extracts of heated eggs have also been reported as effective. From such facts it seems unlikely that the explanation of the ultimate failure of growth when certain of the natural fats supply the fat component of the diet is to be found in some destructive reaction brought about by preliminary heating. MC COLLUM and DAVIS believe that the substance which exerts a stimulating action on the growth of rats is sufficiently stable to withstand conditions of saponification which they have employed.

The authors have found that by fractional crystallization from alcohol it is possible to concentrate the growth-promoting factor present in butter-fat and beef fat. It remains in the mother liquor or "oil" fractions, whereas the fractions containing the fats with high melting points are ineffective. In order to learn whether the growth-promoting substance retains its physiological potency when kept for long periods, samples of butter fat and butter "oil" were stored: 1) at 18°C., in the light; 2) at 18°C. in the dark; 3) at 8° C. in the dark. Their efficiency in restoring growth, etc., was subsequently tested on animals that had failed on the "lard diets". The results indicate the pronounced stability of the growth-promoting substance as contained in butter fat under ordinary conditions of storage. However, in the butter "oil" gradual deterioration occurred, so that within a year its characteristic growth-promoting potency was eventually almost completely lost.

The feature here involved has a practical bearing in relation to the storage of butter and other fat products.

661 — **A Vitamine Favouring Growth, Isolated from the Pancreas of the Sheep.** — EDDY, W. H. (Chemical Laboratory of the New York Hospital), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 113-126 + 9 Diagrams. Baltimore, 1916.

By treating the water-soluble part of the alcoholic extract of the sheeps' pancreas with Lloyd's reagent, the author isolated a substance which, when fed to rats, was found capable of aiding their growth.

This substance, which is separated from the extract as a phosphotungstic precipitate, is neither a protein, nor a fat, nor an amino-acid combination.

**662 — The Nature of the Dietary Deficiencies of the Wheat Embryo (1).** — MC. COLLUM, E. V., SIMMONDS, NINA and FITZ, WALTER (Laboratory of Agricultural Chemistry of the Wisconsin Experiment Station, Madison), in *The Journal of Biological Chemistry*, Vol. XXV, No. 1, pp. 105-131, 19 Diagr. Baltimore, Md., May, 1916.

The experiments reported in this paper reveal the fact that the wheat embryo contains qualitatively all the factors essential for the promotion of growth and well-being in an animal, but these are not so proportioned that it can serve as a satisfactory diet without several modifications.

The mineral content must be modified in certain respects before growth can proceed at all.

The character of the proteins is excellent; no other proteins from plant sources which the authors have studied are superior to them. Rations containing but 10 per cent of these proteins are wholly adequate for growth at the maximum rate.

Both the fat-soluble *A* and the water-soluble *B* are present; the first, in moderate concentration; the second, in very high concentration as measured by the needs of the growing animal. Two per cent of wheat embryo supplies enough of the water soluble *B* to promote growth at the normal rate for several months.

There is contained in the wheat germ a substance which is distinctly toxic to animals. This is in great measure removed by extraction with ether, and is found in the fat fraction. The writers have not yet determined whether the toxicity is due to peculiarities in the chemical nature of the fats themselves or to something which is associated with the fats.

**663 — Studies of Cotton-seed as Food (2).** — I. WELLS, C. A. and EWING, P. W., Cottonseed Meal as Incomplete Food (Georgia Experiment Station), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 2, pp. 15-25, Bibliography of 8 publications. Baltimore, Md., 1916. — II. OSBORNE, THOMAS B. and MENDEL, LAFAYETTE B., The Use of Cotton Seed as Food (Laboratory of the Connecticut Agricultural Experiment Station and the Sheffield Laboratory of Physiological Chemistry in Yale University, New Haven), *Ibid.*, Vol. XXIX, No. 2, pp. 289-317, 5 Diagr. Baltimore, Md., March, 1917.

I. — The results of former experiments (WELLS and EWING, Acidosis and Cotton-seed Meal Injury, *Georgia Agricultural Experiment Station*, Bulletin 119, 1916) had indicated that in feeding cotton-seed meal to pigs to ascertain the injury said to result from this it is necessary to balance the ration, not so much as to the nutritive ratio, determined by the amounts of fats, carbohydrates, and protein present, but rather as to the so-called accessory food factors. The present paper relates the writers' further experiments bearing upon this phase of the question. They were carried out on Duroc Jersey pigs; the conclusions arrived at are as follows: —

Cotton-seed meal is an incomplete food. This is true even when it is fed with sugar and starch to a wide nutritive ratio.

(1) See *R.*, January 1918, No. 2. (*Ed.*)

(2) See also *R.*, January 1918, No. 64; March 1918, No. 306; April 1918, No. 443. (*Ed.*)

Pigs upon an absolute maintenance diet ate in addition only small quantities of cotton-seed meal and were not greatly injured by it.

So called cotton-seed meal injury is due in large part to inadequate diets.

II. — Cotton-seed meal is one of the most valuable feedstuffs at the command of the American stockman. After the animal has digested it, the value of the residue as fertilizer is about three-fourths the original value of the meal. The United States uses only part of the cotton-seed meal which it produces and one of the reasons which prevent a larger domestic consumption of this by-product of the cotton industry is the danger that sickness and death may follow its use. Cattle fed for more than 90 to 120 days on a heavy cotton seed meal ration (6 pounds or more per head daily) become lame, and their eyes discharge freely, blindness often resulting. Deaths may occur, especially in young animals. Pigs are peculiarly susceptible to the effects of cotton-seed meal, possibly because they are usually fed a larger quantity of the meal in proportion to their body weight. In feeding pigs, symptoms of sickness may appear at any time after 3 weeks of feeding, and deaths frequently occur with little warning. Various systems of feeding cotton-seed meal to pigs have been devised. Some of them appear to minimize its danger somewhat, but none of them prevent it entirely. This product, therefore, can not be regarded as a safe feed for pigs in the combinations in which it has heretofore usually been fed. (ROMMEL, G. M., and VEDDER, E. B., *Journal of Agricultural Research*, Vol. V, p. 489, 1915).

Referring to the experiments in feeding cotton-seed meal which have been made by various agricultural station workers, WELLS, C. A., and EWING P. V. (*Georgia Agricultural Experiment Station, Bull.* 119, 1916) state that the results of such experiments do not entirely agree and few absolute conclusions can be drawn from them. They indicate, however, that swine (particularly young pigs), calves, sheep, horses, cows, steers, dogs, cats, guinea pigs, rabbits, fish, poultry, and other animals may be injured by eating cotton-seed meal. Some of the smaller animals, such as pigs and calves, seem to be more susceptible to its injury than cows, steers, and similar animals. This, however, may have been due to their youth, or, more probably, to a consumption of larger quantities of meal in proportion to their live weight. When the meal was fed in connection with pasturage, or when it had been steamed, boiled or fermented, or when fed with mineral matter, particularly iron compounds, it often seemed to exert no apparent injury to pigs even when fed in rather large quantities. The injury resulting from the feeding of cotton-seed meal to stock has been attributed to : a) the oil in the meal ; b) its crude fibre ; c) excesss of nitrogen and perverted metabolism ; d) the action of bacteria and moulds ; e) presence of betain, cholin, or other alkaloids, and to gossypol ; f) to injurious phosphorous compounds ; g) to a protein group containing loosely bound sulphur, which interferes with normal iron metabolism ; g) to worms and certain other causes of minor importance .

Cotton-seed products for feeding purposes are available in several commercial forms. Cotton-seed *kernels* are obtained when the whole cotton-



seed is decorticated and freed from most of the hulls. Cotton-seed *meal* is the term applied to the ground cotton-seed cake from which most of the oil has been pressed. Cotton-seed *flour* is prepared by finely grinding and sifting the meal, whereby the lint, etc., are removed more completely than from cotton-seed meal.

Two processes are commonly employed in preparing cotton-seed meal. In the first process the seeds are decorticated, ground, and then steamed for about  $\frac{3}{4}$  of an hour. The hot mass is freed from most of the oil by means of hydraulic presses and the resulting press cake is then ground to a meal. In the second process the oil is expressed from the seeds by means of Anderson expellers whereby the meal becomes heated. The residue is then ground as in the first process. The second procedure is frequently called the cold process. Nearly all of the mills in the United States use the method employing live steam.

MARCHLEWSKI, L., (*Journal für praktische Chemie*, Vol. LX, p. 84, 1899) isolated from the "foots" from cotton-seed oil a substance which he named gossypol. WITHERS, W. A. and CARRUTH, F. E. (*Journal of Agricultural Research*, 1915, Vol. 261) (1) have isolated this from cotton-seed *kernels*, by extraction with fat solvents and they report it to be highly toxic to rabbits, guinea pigs, rats, and pigs. They state that the ether-extracted *kernels* are rendered non-toxic by removal of gossypol. According to WITHERS and CARRUTH, "cotton seed meal and flour were found toxic to rabbits but the flour produced no ill effects on rats". The unlike toxicity to rats is explained by the variation in alteration or removal of gossypol in the manufacture of the *meal* from the *kernels*.

To ascertain whether the cotton-seed proteins are, like some proteins from maize, notably deficient for the purposes of nutrition the authors have conducted feeding experiments on white rats for which cotton-seed proteins furnished practically all of the food nitrogen and for which the other essential dietary components were supplied by adding to the products to be tested a suitable mixture of protein-free milk, butter fat, and starch which, with the addition of adequate protein, is sufficient for perfect growth. In this way they have found that satisfactory growth can be made by rats when either cotton-seed *globulin*, or the total cotton-seed protein precipitated from alkali extracts of cotton-seed meal, is employed without significant amounts of other protein in the mixture.

The facts now available are briefly summarized below:

Cotton-seed *kernels* are unsatisfactory for nutrition. Cotton-seed *meal* and *flour* are valuable foods for growing rats, both when used as the sole source of protein in the food, or when used in smaller quantity to supplement other less efficient protein concentrates. The excellent "quality" of the cotton-seed proteins as a whole is attested by the satisfactory growth made on diets furnishing the equivalent of only 9 per cent of protein (N  $\times$  5.4); even with 6 per cent of the protein considerable growth ensued. Cotton-seed *flour* gave good results when used as a supplement to such deci-

(1) See also R., January 1918, No. 64; March 1918, No. 306. (Ed.)

dedly inferior protein concentrates as "corn gluten", distillers' grains, and "vegetable albumin flour".

The injurious substance in the *kernels* can be removed by extraction with ether and, according to WITHERS and CARRUTH, by extraction with carbon bisulphide, chloroform, benzene, or alcohol, but not with petroleum ether or gasoline. The ether soluble material is deleterious, either because it contains some toxic ingredient or because it renders the food containing it so unpalatable that the animals refuse to eat it. This agrees with the results obtained by WITHERS and CARRUTH and by MC COLLUM, SIMMONDS, and PRITZ.

Foods containing cotton-seed oil prepared by pressing the kernels in the cold, or furnished as the crude unbleached commercial oil prepared by heating the kernels before pressing them, are eaten without detriment by rats.

By treatment with steam under suitable conditions the *kernels* lose their deleterious effect on rats. The variations in the results of feeding different samples of cotton-seed meal, which have been reported, may be due to differences in the mode of heating which the products have experienced in their preparation.

As regards the question as to whether so called "cotton-seed injury" in the feeding of domestic animals can be classed with the deficiency diseases, it is quite possible that, as ROMMEL and VEDDER maintain, food mixtures lacking some of the now recognized essential ingredients of an adequate diet have been employed in the past. The authors' experience with rats successfully grown on cotton-seed rations excludes the probability that there is ordinarily any lack of the water-soluble vitamine. Whether the quota of inorganic salts furnished in agricultural practice is always sufficient the writers are unable to answer. It is noteworthy, however, that they have induced young rats to double their weight at a normal rate of growth on a food mixture containing nothing except cotton-seed *meal*, starch, and lard. The deleterious effects of unheated cotton-seed *kernels* cannot be denied. Whether the reputed detrimental effect after feeding some of the commercial cotton-seed meals is associated with a failure to destroy a deleterious constituent or is attributable to unsuitable methods of feeding in some cases is still debatable.

**664 - Test of Three Protein Concentrates and Two Leguminous Roughages in Milk Production.** — HUNZIKER, O. F. and CALDWELL, R. E., in the *Purdue University Agricultural Experiment Station Bulletin* No. 203, pp. 1-20. Lafayette, Indiana, August, 1917.

Results of an experiment designed to give directions to feeders of dairy cows, regarding the type of protein-carrying concentrates and leguminous roughages best adapted for maximum and economical milk yield.

The three protein-carrying concentrates under test were cottonseed meal, linseed meal and gluten feed, and the hays fed were alfalfa hay and soybean hay; ground maize and maize silage were included in all rations.

The experiment covered a period of 180 days and was divided into six periods of 30 days each, 15 cows being used, divided into 3 lots of 5 cows each.

The rations used in the experiment are given in the following schedule :

1. Ground maize, cottonseed meal, alfalfa hay and maize silage.
2. Ground maize, cottonseed meal, soybean hay and maize silage.
3. Ground maize, linseed meal, alfalfa hay and maize silage.
4. Ground maize, linseed meal, soybean hay and maize silage.
5. Ground maize, gluten feed, alfalfa hay and maize silage.
6. Ground maize, gluten feed, soybean hay and maize silage.

The cows used were : 13 pure bred Jerseys and 2 pure bred Ayrshires fresh approximately 75 days before they were placed in the experiment.

The average daily feeds consumed during the entire experiment are shown in Table I.

TABLE I. — *Showing Average Daily Feeds consumed — Entire Experiment.*

Ration	Ground maize lb.	Cottonseed meal lb.	Linseed meal lb.	Gluten feed lb.	Alfalfa hay lb.	Soybean hay lb.	Maize silage lb.
1	7.88	0.49	—	—	8.52	—	24.50
2	7.44	0.78	—	—	—	7.43	25.07
3	7.66	—	0.55	—	8.54	—	25.00
4	7.40	—	1.06	—	—	7.65	24.81
5	7.24	—	—	0.90	8.27	—	25.10
6	6.02	—	—	1.61	—	7.62	25.24

The average daily production of milk for each of the 6 periods of the experiment was not especially high, averaging 19.64 lb. for all cows when receiving alfalfa hay and 18.41 lb. for all cows when receiving soybean hay. The low daily milk production may be accredited to the fact that the cows were mostly pure-bred Jerseys, having a rather high fat content.

Table II shows the amount of dry matter required to produce a unit of product.

TABLE II. — *Showing the Amount of Dry Matter Required to Produce a Unit of Product.*

Ration	Average daily milk produced lb.	Average daily butter fat produced lb.	Average daily dry matter consumed lb.	Dry matter required per 100 lb. milk lb.	Dry matter required per pound butter fat lb.
1	20.18	0.9224	22.899	113.42	24.76
2	19.93	0.9346	22.901	121.99	25.88
3	19.85	0.9064	22.605	114.92	24.47
4	17.31	0.8161	21.120	113.75	24.35
5	18.89	0.8822	21.483	113.85	24.94
6	17.98	0.8246	20.817	115.74	25.25

The cost of the product, considering feed cost alone (1), is given in Table III together with the value of the product, calculating all butter fat at 30 cents per pound and the skim milk at 25 cents per hundred pounds.

TABLE III. — *Showing Cost of Product.*

Ration	Average daily cost of feed	Average daily value of product	Cost per 100 pound milk produced	Cost per pound butter fat produced	Production per \$ 1.0 worth of feed
1	\$ 0.1925	\$ 0.32	\$ 0.98	\$ 0.216	\$ 1.605
2	0.1901	0.28	1.10	0.234	1.464
3	0.1997	0.32	1.00	0.213	1.602
4	0.1990	0.30	1.05	0.226	1.523
5	0.1968	0.31	0.99	0.218	1.589
6	0.1895	0.28	1.05	0.229	1.498

The average daily cost apparently was not influenced by the type of protein-carrying concentrates used. The variation in cost was doubtless influenced chiefly by the roughage fed. The type of roughage used produced an average variation in the total value of the product from \$9.52 when alfalfa hay was fed to \$8.67 when soybean hay was fed, or about 4 cents per day.

The conclusions drawn as a result of the discussion of the data presented in the foregoing tables may be summarized as follows :—

A ration used in milk production, which contains ground maize, maize silage and a leguminous hay, requires a very limited amount of protein-carrying concentrates in order that it may be properly balanced. The three protein-carrying concentrates used in the experiment affected the cost of the ration less than any of the four feeds of which the ration was composed.

When fed in connection with alfalfa hay, cottonseed meal was the most economical source of protein, gluten feed ranking second and linseed meal standing third, using prices as shown in the note (1).

Alfalfa hay was 12 % more economical as a milk producing roughage than soybean hay, both selling at the same price per ton, and without taking into account the greater quantity of soybean hay refused, due to its unpalatable character. The cost of milk was affected to the greatest degree by varying the price of maize. Hay ranked second, maize silage third and the protein-carrying concentrates fourth. The hay and maize exert practically the same influence upon the cost of milk.

The use of soybean hay caused an increase in body weight and a decrease in daily milk and butter fat production.

Properly balanced rations were, approximately, equally efficient in the production of milk and butter fat per unit consumption of dry matter.

(1) Prices of feeds used were as follows : Cottonseed meal \$ 30 per ton ; linseed meal \$ 36 per ton ; gluten feed \$ 28.50 per ton ; ground maize \$ 0.60 per bushel ; alfalfa hay \$ 15 per ton ; soybean hay \$ 15 per ton ; maize silage \$ 3.50 per ton.

665 - Feeding with Maize Silage and Ground Cotton Cake : Its Influence on the Composition and Quality of the Butter. — See No. 696 of this Review.

666 - The Role of Water in a Dairy Cow's Ration; Investigations made in U. S. A. — LARSEN, C., HUNGERFORD, E. H. and BAILEY, D. E., in *South Dakota State College of Agriculture and Mechanic Arts, Agricultural Experiment Station, Bulletin No. 175*, pp. 648-691 + 16 Tables. Huron, April, 1917.

CATTLE

Some dairymen claim that if the amount of drinking water given to a cow is limited, the body temperature is raised and the composition of the milk modified, the percentage of fat especially being increased. In order to verify this assertion the authors undertook a series of experiments (1) on the effect of watering cows at different intervals with varying quantities of water on the following factors: — amount of food consumed, digestibility of food, quantity and composition of faeces and urine, quantity and composition of milk, composition and quality of butter fat, body temperature and physical condition of the cow. Data on the mineral metabolism of the cow were also obtained. The experiment, carried out on four animals, was divided into three periods, separated by a period in which the ration was normal. In the first period the animals were watered every 24 hours (an average of 61.65 lb. per head), in the second period every 60 hours (an average of 51.20 lb. per head), in the third period with half the normal ration of water (40.00 lb. per head).

A series of tables gives: — Composition of feed and water; weight of animals, amount of food consumed and daily milk yield, coefficients of digestibility of the rations, amount of water drunk and food digested daily, daily amount and composition of the faeces, relation of amount of water to dry matter consumed, average daily amounts and composition of the urine and the milk, analysis of butter fat, average temperature of the shed and cows, effect of room temperature on the total amount and percentage of fat in the milk; food constituents digested per 1000 lb. of live weight daily, daily energy

(1) The effect of varying quantities of water in the ration on the composition of milk has been studied by many authors. TURNER, SHAW, MORTON and WRIGHT compared experimentally: — 1) a full allowance with a limited allowance of water; 2) a heavy ration of turnips with a dry roughage ration; 3) wet beet pulp with dry beet pulp; 4) green clover with cured hay. They proved that, though individual cows produced milk with an abnormal fat content, the different rations did not as a rule influence either the quantity or the composition of the milk.

GILCHRIST (Variations in the Composition of Milk and their Probable Causes, *Durham County Council Education Committee Reports, Dairy Investigations, Offerton Hall*, pp. 7-27: 1909) found little or no difference in the quantity and quality of milk produced by cows either on pasture or a heavy mangel ration and that produced by cows on a ration of hay and grain.

ARMSTRONG found that cows drink more when fed a heavy protein ration than when fed a low protein ration, and that cows fed dry roughage drink about 40 lb. more water per day than those fed green hay. (*Authors.*)

See also the summary of the results obtained by various workers in experiments on the influence of the composition of the ration on milk secretion, read by KELLNER at the International Dairy Congress held at Budapest, June, 1909, in the *Journal of the Board of Agriculture*, Vol. XVI, No. 8, pp. 649-654, London, November, 1909; the author proves the influence to be very slight. See also *B.* 1912, Nos. 150 and 682; 1916, No. 885; 1917, No. 347; 1918, No. 63. (*Ed.*)

requirement per 1000 lb. live weight, distribution of water in the cow's body, average daily rations and balance of food nutrients in the three periods of the experiment.

RESULTS. — 1) *Food consumed.* — When the cows are watered once in 24 hours instead of two or three times there is a slight decrease in the total amount of food taken and in the quantity of milk produced, but this second decrease is not proportionate to the first. During the 30 days of the experiment the animals lost an average of 11 lb. per head. This loss was much greater during the second test (17 lb.) and the third (95 lb. per head on an average).

During the periods in which the cows received a full ration of water at long intervals, the expected decrease in milk production was not obtained. If the slight decrease in the amount of food consumed and the loss in weight be considered it must be concluded that cows can utilise the water stored in their systems for milk production and other functions. When the cows only received half the normal quantity of water (test 3) there was a marked decrease in the amount of hay consumed, milk produced and in body weight.

2) *Digestion of rations.* — The coefficient of digestibility was increased in each of the tests in which the intervals between watering were lengthened and in those in which the cows only received half the normal ration of water. This increase in the coefficient of digestibility is particularly marked in the case of crude fibre. Cows watered once in 24 hours digested 55 % of crude fibre as compared with 54 % digested by the control animals watered three times a day; cows watered once in 60 hours digested 71.07 % of fibre as against 55.7 % by the control animals, and those receiving half a ration of water digested about 2 % more than the control animals.

The increase in the digestibility of the nitrogen free extract and of the protein is not regular and is less marked.

As regards the actual amount of crude fibre digested, the cows in test 1 digested about 0.09 lb. per head daily, and those in test 2 only 1.26 lb. more than the control animals, those of test 3 digested 1.125 lb. less than the control animals.

Numerous investigations have led to the general acceptance of the theory that the digestibility of crude fibre depends largely on the active bacteria present in the intestinal tract and the action of the digestive juices. It is probable that an increased amount of water retards bacterial action in digesting crude fibre, and that a decreased amount leaves the digestive juices more concentrated and, therefore, more efficient and makes the chyme firmer and slower in moving through the digestive tract so that it is exposed for a longer period to the action of the secretions in the tract.

These results show that to obtain the most efficient digestion of food it is wise not to water the animals too abundantly at feeding time or immediately before or after a heavy meal.

3) *Effects of the quantity of water ingested on the composition of the excreta.* — The percentage of water in the faeces and the urine varies but little with the different quantities of water ingested; there was almost no difference between the faeces of the control animals and those in tests 1 and 2;

in test 3 there was a decrease of about 2 %. Frequent watering seems to have no appreciable effect on the composition of the faeces except that lengthening the intervals between drinking slightly reduces the crude fibre. When the cows only received half the normal ration of water there was an increase in the protein, nitrogen-free extract and crude fibre contained in the faeces.

When the cows received an unlimited supply of water three times a day they drank 3.5 lb. for every pound of dry matter consumed, when watered once in 60 hours they drank 2.38 lb. per pound of dry matter, and when receiving half the normal ration of water every 24 hours they drank 1.8 lb. per pound of dry matter.

4) *Effect of the quantity of water ingested on the quantity and composition of the milk.* — In all the tests the composition of the milk and butter fat remained absolutely unchanged. It is for this reason that a cow receiving insufficient water goes dry without there being any modification in the composition of her milk. Frequent watering has little influence on the quantity of milk produced. When the normal water ration was reduced by half the milk yield was reduced a little at the beginning, this reduction increasing as the experiment continued till it was about  $\frac{1}{4}$ . There is no doubt that the cows would have gone dry if this ration had been continued.

5) *Effect of water on the body temperature of the cow.* — When the cows were watered every 24 hours the body temperature was lowered by the fraction of one degree Fahrenheit 15 minutes after watering. With intervals of 60 hours the temperature dropped 2° F. The minimum was obtained 1 to 1½ hours after watering (130 lb. of water per head). The temperature of cows receiving half the normal ration of water was 1° F. higher than when they received a normal amount, but there was no increase in the fat content of the milk.

During a special experiment the cows were exposed to room temperatures varying from 51 to 104° F. It was found that the fat content tends to increase with the body temperature, though the increase is but slight; about 4.4% for 69° F. and 5.04% for 104.8° F. Since, however, high temperature slightly reduces milk secretion, the total amount of fat increases in inverse ratio to the percentage, in the case quoted from 11.2 lb. to 10.2 lb. per head daily. In conclusion it may be said that keeping dairy cows in milk in hot sheds, blanketing them and withholding water in order to raise the fat content is very dangerous to their health.

6) *Physical condition of the cows.* — The abnormal conditions brought about by withholding water were nervousness, gauntness and high body temperature. When the animals were watered every 60 hours and when they received half the normal ration of water a larger amount of energy was required to accomplish the body functions.

7) *Chief functions of water in a dairy cow's ration.* — The results of their experiments led the authors to the following conclusions: — A good dairy cow probably requires more water than any other domestic animal. Water dissolves food (for this reason the more food an animal eats; the more drink it requires), distributes it to the different parts of the body and removes the

waste products. The authors showed that more than 12 % of the total water drunk is eliminated through the skin in winter in the shed, and 27 % in August ; 56 % of the water drunk is eliminated in the faeces and 15 % in the urine. On an average, 15 % of the water drunk passes into the milk (in good milkers this percentage is higher; in one of the experiment animals, among which there were no choice cows, this percentage was 24 %). Water regulates the body temperature ; the loss of water through the body was twice as great in August as in January.

**667 - The Influence of Parturition on the Composition and Properties of the Milk and Milk Fat of the Cow.** — ECKLES, C. B. and LEROY, S. PALMER (Department of Dairy Husbandry, University of Missouri, Columbia), in *The Journal of Biological Chemistry*, Vol. XXVII, No 2, pp. 313-326. Baltimore, Md., 1916

The general opinion prevails that cows' milk is not suitable for human food for a period of time after parturition. Opinion varies as to the length of time the milk is unfit for use, as low as 2 days and as high as 15 days being stated as the proper period by different authorities. The methods and standards for certified milk adopted by the American Association of Medical Commissions place the figure at 7 days after parturition. The basis for the exclusion of cows' milk immediately after the birth of the calf is that its composition or constituents give rise to intestinal disorders. The evidence upon which this conclusion is based is, however, extremely difficult to find.

The data which are offered in the present paper indicate that colostrum milk is subject to variations in composition, or in other words that the effect of parturition on the composition of cows' milk may be greatly influenced by other factors. Data are presented on two questions: 1) the effect of milking the cow up to the time of parturition ; 2) the influence of the length of the period the cow is dry before parturition.

The conclusions which the authors have drawn from these data are the following :—

Parturition in the case of the cow is normally accompanied by the production of milk of extremely abnormal composition, called colostrum.

When cows are milked up to parturition, however, the colostrum milk and milk fat are much less abnormal in composition and follow closely the composition of the milk and milk fat given before parturition.

The chief characteristic of the milk as the cow approaches parturition in these cases is the marked increase in the content of heat-coagulable proteins, which reach their maximum in the first milk following parturition, that is, the true colostrum milk. This would indicate that a high content of heat-coagulable proteins is the chief, if not the only, real effect of parturition on the milk.

The length of time the cow is dry before parturition is a factor influencing the composition of colostrum milk, but does not influence the composition of colostrum milk fat. The shorter the time the cow is dry the less abnormal will be the composition of the colostrum milk.

(1) See also R. April 1918, No. 445. (*Ed.*



668 — **Winter Steer Feeding in Indiana, U. S. U.** — SKINNER, J. H. and KING, G. F., in the *Purdue University, Agricultural Experiment Station, Bulletin No. 191*, Vol. XIX, pp. 1-35. Lafayette, Indiana, September, 1916.

The experiments described were undertaken to determine: — 1) the comparative value of leguminous hay alone and in combination with maize silage as roughage for fattening cattle; 2) the comparative value of clover hay and alfalfa hay as roughage for full-fed cattle; 3) the value of feeding molasses and mixed molasses feeds for fattening cattle; 4) the comparative value of a limited feed of maize with maize silage and a full feed of maize for finishing steers.

For the purposes of the experiment 70 medium feeding cattle were used. These were divided into seven lots of 10 steers each, as far as possible equal in size, condition, breeding, etc., and kept under similar conditions. The experiment lasted 150 days. With each lot of cattle were 10 good quality hogs, with an average weight of 105 lb. each when the experiment started. In addition to droppings from the cattle all the hogs received as much maize as they could eat; in addition five hogs in lots 2, 3 and 4 also received a small quantity of shorts and kitchen waste.

*Maize silage and leguminous hay v. leguminous hay (Lots 2, 4, 3 and 7)* — The rations were composed of shelled maize, cottonseed meal (2.5 lb. daily per 1000 lb. live weight), clover or alfalfa hay, with and without maize silage.

The table shows that the addition of maize silage to the ration reduced the maize required and practically replaced hay. It also shows the average daily gain, cost of gain per 100 lb., and profit per steer with and without pork. It is seen that the addition of maize silage to a ration of shelled maize, cottonseed meal and clover had very little effect on the gains made by the cattle, whereas when alfalfa hay was substituted for clover hay the difference in gain was marked. Although the additions of maize silage to the ration with clover hay slightly reduced the gain (0.07 lb.), it also reduced the cost of gain by 94 cents per 100 lb. In the ration with alfalfa hay the addition of maize silage both raised the gain (0.29 lb.) and reduced the cost of gain (\$ 2.30 per 100 lb.)

*Limited feed of maize v. full feed of maize (Lots 1 and 4).* — During the five months of the experiment Lot 1 received a ration of maize silage, clover hay and cottonseed meal, with maize in the following varying amounts daily per steer — 1st month, none; 2nd month, 5 lb.; 3rd month, 7 lb.; 4th month, 8 lb.; 5th month, 9 lb. Lot 4 received a ration of cottonseed meal, clover hay, maize silage, and as much maize as the animals would eat after having been gradually worked on to a full feed.

From the table it is seen that the steers on a limited feed of maize ate larger quantities of both clover hay and silage than those on full feed. The average difference in maize consumption was 4.01 lb. daily throughout the whole period.

The table also shows that the average daily gain per steer was  $\frac{1}{10}$  lb. in favour of an unlimited maize supply, but the gain was less economical, costing 84 cents per 100 lb. more than when limited maize was fed. The

Ration	Lot 1 Cottonseed meal, clover hay, maize silage limited shelled maize lb.	Lot 2 Shelled maize, cottonseed meal clover hay lb.	Lot 3 Shelled maize, cottonseed meal alfalfa hay lb.	Lot 4 Shelled maize, cottonseed meal clover hay + maize silage lb.	Lot 5 Shelled maize, clover hay maize silage cottonseed meal + cane molasses lb.	Lot 6 Shelled maize, clover hay, maize silage, molasses feed lb.	Lot 7 Shelled maize, cottonseed meal alfalfa hay + maize silage lb.
<i>Average daily feed consumed per head, December 1, 1915 to April 29, 1916 (150 days).</i>							
Shelled maize . . . . .	5.80	12.34	14.34	9.81	7.68	7.68	9.57
Cottonseed meal . . . . .	2.44	2.47	2.42	2.45	2.48	—	2.53
Molasses . . . . .	—	—	—	—	2.59	—	—
Molasses feed . . . . .	—	—	—	—	—	5.17	—
Clover hay . . . . .	3.09	12.67	—	2.04	2.00	1.96	—
Alfalfa hay . . . . .	—	—	11.97	—	—	—	1.95
Maize silage . . . . .	33.01	—	—	28.64	32.65	29.54	30.81

*Average daily gain: cost of gain and profit per steer.*

	Lot 1	Lot 2	Lot 3	Lot 4	Lot 5	Lot 6	Lot 7
Average daily gain . . . . .	1.92 lb.	2.09 lb.	2.06 lb.	2.35 lb.	2.25 lb.	1.90 lb.	2.35 lb.
Cost of gain per 100 lb. . . . .	\$ 10.55	\$ 12.33	\$ 12.23	\$ 9.93	\$ 11.35	\$ 12.73	\$ 9.93
Profit per steer with pork . . . . .	\$ 9.26	\$ 3.97	\$ 4.09	\$ 12.10	\$ 7.48	\$ 3.16	\$ 12.10
Profit per steer without pork . . . . .	\$ 14.63	\$ 9.55	\$ 10.59	\$ 17.61	\$ 11.52	\$ 9.24	\$ 17.61

profit from full-fed cattle was \$ 1.66 less than that from those given limited maize.

*Clover hay v. alfalfa hay as roughage* (Lots 2, 4, 3 and 7) When hay was the only form of roughage the cattle receiving clover ate the same quantity of maize but slightly more hay (0.7 lb. daily) than those receiving alfalfa. When, however, silage was added, those receiving alfalfa ate slightly less grain and hay but more silage than those receiving clover. The average amount of food consumed daily is shown in the table.

When clover or alfalfa were fed as the only roughage there was practically no difference in any of the principal factors influencing profit or loss; the rate and cost of gain were practically the same in each case. When, however, silage was added to the ration the cattle receiving alfalfa hay surpassed those receiving clover hay in every factor except pork production, their rate of gain was more rapid and more economical, their finish was better and the profit per steer higher. It is difficult to account for this marked superiority by the slight difference in the rations consumed; it was more likely due to a difference in the individuality of the cattle, although such a difference was not evident. It is notable that in all the trials comparing the value of clover hay and alfalfa hay with maize silage, the cattle which most nearly replaced hay by silage made the most rapid and economical gains. The average results of this experiment are given in the table.

*Cane molasses v. molasses feed* (Lots 4, 5 and 6). — The rations fed were composed of shelled maize, cottonseed meal (2.5 lb. daily per 1 000 lb. live weight), maize silage, and clover hay, varied with either cane molasses or molasses feed. If feeds containing molasses improve the appetites of cattle they may clearly be of great value. The table shows the effects of the different rations on the appetites of the cattle. It will be seen that the addition of molasses to the ration increased the appetites of the cattle, the increase being shown more particularly by the amount of silage consumed. The molasses feed was much relished by the animals.

The addition of molasses to the ration increased the rate of gain, whereas when molasses feed was substituted for cottonseed meal the rate of gain was reduced. The addition of molasses made very little difference in the cost of gain, but the use of molasses feed instead of cottonseed meal materially increased this cost. It should be noted that the most efficient ration from the point of view of gain and the finish of the cattle was that composed of shelled maize, cottonseed meal, molasses, clover hay and maize silage, but the most economical ration was that composed of shelled maize, cottonseed meal, clover hay and maize silage.

A detailed financial statement of the experiments is appended to the bulletin.

669 — **Fattening Western Lambs in U. S. A.** — SKINNER, J. H. and KING, F. C., in the *Purdue University Agricultural Experiment Station, Bul. div. No. 192. Vol. XIX, pp. 1-26.* Lafayette, September, 1916.

SHEEP

The object of the experiment was to compare the feeding values for fattening lambs of : — 1) clover hay and maize silage alone and in combination : 2) maize silage alone and in combination with dry roughage ;

3) clover hay and alfalfa hay; 4) cottonseed meal as a supplement to rations of maize, clover hay and maize silage; 5) cottonseed meal and ground soy beans as supplements to rations; 6) molasses. The influence of shelter on fattening lambs was also studied.

Two hundred and twenty-five choice improved Mexican lambs were used. They were of excellent quality and remarkably uniform in size, type, quality and condition. The lambs were divided into 9 lots of 25 each. Eight of these lots were placed in an open shed and fed different rations, the ninth lot was fed in a barn upon a ration similar to that of Lot 6 in the open shed. The experiment lasted 100 days.

*Maize silage and clover hay* (Lots 3 and 6). — Both lots of lambs were started with a ration of 14 lb. of oats daily for 25 lambs. At the end of the 7th day maize was added to the ration and oats gradually eliminated till, by the 17th day, each lot was receiving the experimental rations only. It was only after the 17th day that more than 1 lb. of silage daily per lamb was consumed, but at no time was less than 1 lb. of hay eaten daily per lamb. The appended table shows the results obtained.

It is seen that the difference in daily gain is practically negligible. There was a saving of 81 cents in the cost of 100 lb. gain when silage was used, and an increased profit of 29 cents per head.

*Maize silage v. maize silage and dry roughage* (Lots 1, 5, and 7). — All the lambs received a grain ration of 7 parts shelled maize and 1 part cottonseed meal. At the end of 80 days, the lambs of Lot 1, receiving only silage as roughage, went off very badly and their ration had to be materially reduced and one feed of clover hay given to make them eat well again.

The table shows that the elimination of dry roughage from the ration decreased the grain consumption and increased the silage consumption, but not in proportion to the dry matter removed by the elimination of clover hay. The elimination of clover hay also decreased the profit per lamb and the rate of gain. The rate of gain and profit per lamb was lowest when oat straw was added to the silage. The finish on the lambs was much the best when clover hay and silage were fed.

*Clover hay v. alfalfa hay* (Lots 3 and 4). — The only difference in the rations fed was that one lot received clover hay, the other alfalfa hay. It will be seen from the Table that the grain consumed was the same in both cases, but that more hay was eaten when clover was fed. The best results, however, as regards gain, profit and finish, were obtained with alfalfa. These results do not agree with two similar trials made at Purdue; this is probably due to the fact that, though the best clover hay procurable was used, it was only of medium quality and not entirely free from mould, whereas the alfalfa hay was of excellent quality and well cured.

*Cottonseed meal as a supplement* (Lots 6 and 7). — At the end of 12 days 1 lb. of cottonseed meal for 25 lambs was introduced into the ration, and gradually increased till, at the end of 20 days Lot 7 was receiving 3 lb. of cottonseed meal and 21 lb. of maize, as compared with 24 lb. of maize given to Lot 6. Both lots were then given all the grain, hay, and silage they would eat, the cottonseed meal being kept in the proportion of 1 lb. to 7 lb. of

maize. At no time was there any difference in the quantity of food eaten by the two lots. The table shows that, though the addition of cottonseed meal to the ration increased the cost, it also increased the rate of gain and the profit. This is in accordance with previous trials which showed the great merit of cottonseed meal to lie in the improved finish it gave the lambs.

*Molasses* (Lots 2 and 7). — The only difference in the rations of the two lots was that Lot 2 was given 4 lb. of cane molasses daily in place of 4 lb. of maize. The amount of food eaten was almost the same in both lots, though the addition of molasses slightly increased the appetite of the lambs. The rate of gain was slightly higher when molasses was fed, but, owing to the high price of the molasses, the profit was less; this was also partly due to the fact that the finish on the lambs in Lot 2 was less good than those on Lot 7.

*Ground soybeans v. cottonseed meal as a supplement* (Lots 7 and 8) — The only difference in the rations was the substitution of ground soybeans for cottonseed meal. The table shows the daily food consumption to be practically the same in both cases. The small difference in the rate of gain, the cost of gain and the profit made were in favour of cottonseed meal.

*Open shed v. barn as shelter* (Lots 6 and 9). — Lot 6 was fed in an open shed containing a space 14 × 16 ft. under cover and 14 × 14 ft. in the open. Lot 9 was fed in a barn 36 × 44 ft. with three windows in the north, one in the south, and one in the east, all of which were kept open. The lambs, the only animals in the barn, were confined in a space of 14 × 24 ft.

Both lots were fed similar rations composed of shelled maize, clover hay, and maize silage. The results given in the appended table show that the grain and hay consumed was the same in both cases, but that Lot 6 ate more silage. This was because the lambs in the barn did not eat silage as early as those in the open; when they had learnt to eat it well, the amount consumed was about equal in both lots. The lambs in the open shed made more rapid and economical gains than those in the barn, but the finish was the same in both cases. These results confirm those obtained in previous trials.

	Lot I	Lot II	Lot III	Lot IV	Lot V	Lot VI	Lot VII	Lot VIII	Lot IX
Combinations of feeds	Shelled maize, cottonseed meal, maize stlage.	Shelled maize, cottonseed meal, clover hay, maize stlage, cane molasses.	Shelled maize, clover hay.	Shelled maize, alfalfa hay.	Shelled maize, cottonseed meal, oat straw + maize stlage.	Shelled maize, clover hay, maize stlage (open shed).	Shelled maize, cottonseed meal, clover hay + maize stlage.	Shelled maize, clover hay, maize stlage, ground soybeans.	Shelled maize, clover hay, maize stlage (Barn).
Average daily gain lb.	0.175	0.256	0.24	0.26	0.172	0.247	0.252	0.243	0.239
Average daily feed:									
grain . . . . . lb.	0.96	1.02	1.01	1.01	1.00	1.01	1.01	1.01	1.01
hay . . . . . lb.	0.10	1.19	1.82	1.70	0.63	1.17	1.17	1.16	1.17
silage . . . . . lb.	1.88	1.12	—	—	1.27	1.12	1.12	1.12	1.09
Cost per 100 lb. gain \$	8.86	8.49	8.81	7.87	9.11	8.00	8.26	8.52	8.27
Profit per lamb . . \$	0.80	1.29	1.02	1.74	0.46	1.31	1.74	1.45	1.22

670 - **The Wintering of Bees in Ontario, Canada.** — PETTIT, MORLEY, in *Ontario Department of Agriculture, Bulletin* No. 256, pp. 24 + 11 FIGS. Toronto, Ontario, October, 1917.

The beekeepers of Ontario lose each year from 10 to 50 % of their colonies through winter and spring losses.

American bee literature is full of theories on the wintering of bees and on the causes of the losses therefrom. Many of these theories have been rejected or ignored. As the result of numerous experiments and a free interchange of ideas, however, successful beekeepers have evolved methods of wintering based on principles which recent scientific research has on the whole proved to be correct,

Beekeepers in Ontario adopt two methods of wintering. Some place their hives in a cellar and attempt to keep the bees inactive by controlling the environmental factors, such as light, temperature, ventilation, etc., till the weather permits the bees to renew their summer activities. Others protect the hives on the summer stands, leaving the bees free to go out and to fly whenever the weather permits them to do so. Both of these methods, if intelligently carried out, give good results.

For outdoor wintering the hives are placed in collapsible wooden boxes the sides of which are joined by cleats. Many beekeepers place one hive in each box, others two and others four per box. In this last case two hives are placed facing west and the two others facing east. Between the box and the hive is a space of 3 inches, and between the roof of the hive and that of the box a space of 8 or 10 inches is left. The box is placed on a solid stand 8 inches high which prevents draught of air underneath.

The entrance holes are cut in the side of the box so that the bees may go out in suitable weather. The hives are packed for winter as soon as possible after the supers have been removed, and in October the bees are given an abundant supply of maple sugar. The author gives the measurements of the different parts used for constructing wintering boxes, the size of which depends on that of the hives.

Till a few years ago the most common method of wintering in northern climates was that of keeping the hives in a cellar. Most beekeepers in Ontario and the northern States found that their bees wintered better in cellars than out of doors. Since the improvement of the method described above, however, outside wintering is generally preferred even as far north as New Ontario. Nevertheless, many still prefer cellar wintering. The general conditions required for cellar wintering are:— 1) total darkness, 2) a uniform temperature between 40° to 45°F. The conditions are obtained most satisfactorily in cellars which are almost entirely underground as they are less subject to changes in outside temperature. The air of the cellar must be kept pure by a suitable system of ventilation, and must be neither too dry nor too damp.

The hives themselves must have good ventilation; this may be obtained by removing the summer covers and placing on the top a layer of felt, a cushion of chaff, etc. The hives are placed one above the other, those in the bottom row resting on a stand at least 1 foot above the cellar floor.

The hives are placed in the cellar before the frosts, in southern Ontario in the last days of November, and earlier in the northern districts.

Judgement must be exercised in the removal of the hives from the cellar, the date depending on the condition of the bees and on the season. The best time for setting them out is the evening before or the morning of a day which promises to be fine and calm, but not too hot (60 to 70°F.) When such a day is expected the doors and windows of the cellar are opened at sunset.

Directions are given for the protection of the hives in spring and for feeding the bees. There should be an ample supply of food to avoid any danger of starvation. Autumn is the best time for feeding bees for the following spring.

671 — **Bottini, Colantoni, "Subalpina", and "Sughera" Bee Hives.** — *L'Apicoltura italiana*, Year XIV, No. 3, pp. 29-31 + 1 Fig. Ancona, March, 1918.

The **BOTTINI** hive is made of cement with an "Eternit" cover. The cement is mixed with ingredients which make it a bad conductor of heat so that the bees may be protected from cold in winter as much as possible; this would not be the case with ordinary cement. It has the advantage of lasting for a very long time and of being easy to disinfect thoroughly.

The **COLANTONI** hive only has one medium-sized frame. It combines the advantages of the hive with a moveable top with those of the hive opening at the back. The frame has an opening  $9 \times 13\frac{3}{4}$  inches and may be used both as a brood box and a super. The brood box, which has an opening at the back fitted with glass, makes it possible to estimate the number of young bees, clean the floor easily by raising the shelf, and to place a feeder on the floor. The brood box may even be examined if the super is left in place and the shelves be removed with tongs so long as they are parallel to the entrance.

The "Subalpina" hive, which is an improved **DADANT BLATT** pattern, includes the following parts: — 1) a floor board on two slide-bars which support, at a height of about 16 inches, four strong legs, slanting and hinged in front. At the back there is a movable ledge (which is fixed temporarily when the hives are moved) which closes the opening between the bottom and the brood box. This ledge is used to clean the hive, introduce disinfectants, queens, etc., for transferring, feeding, etc.; 2) a brood box and super, surrounded at the top by a band which serves as a holder and support to the roof; 3) a floor in two or three pieces, the largest of which is double-walled and forms a very practical feeder; it is composed of two cups for the honey or syrup and a third in the centre which has a hole allowing the passage of the bees which may be stopped when the feeder does not work; 4) an "Eternit" roof. The brood box and super are fitted with holes for a ventilation regulator. The nest and honey store may be arranged either parallel or perpendicular to the entrance.

The "Sughera" hive is not of a single pattern; the name is used only to designate the material of which it is made (cork crushed and united by a paste insoluble in water, or by tar, which is not injurious to bees and prevents their being attacked by *Tinea* larvae). Any kind of hive may be built with this material (1).

(1) See R. Feb., 1918, No. 192. (Ed.)

672 — The Common Honey Bee as an Agent in Plum Pollination. — See No. 649 of this Review.

## SERICULTURE

673 — Can the Action of Cold Decrease Mortality among Silkworms Suffering from "Flacherie"? — LOMBARDI, LORENZO P., in *Informazioni seriche*, Year V, No. 2, pp. 19-20. Rome, January 20, 1918.

In the Bulletin No. 1, 1916, of the Agricultural Experiment Station of Crema, an article appeared under the title of "Intestinal Fermentations of the Silkworm", in which it was stated that when silkworms suffering from "flacherie" were subjected to a temperature of 12°C. mortality ceased, and the worms spun their cocoons. The worms were subjected to the low temperature for 48 hours, without food. When replaced in their normal surroundings food was withheld for another six hours.

The author (of the Royal Bacteriological Institute of Portici) was not convinced by these experiments, and in order to verify them, made several tests with silkworms of various breeds.

From the results he concluded that a temporary lowering of the temperature does not definitely improve the condition of silkworms attacked by "flacherie". The disease is only temporarily arrested, and later regains its virulence, causing losses equal on an average to those among the control lots.

674 — On the Discovery of a Plant Suitable for Feeding Silkworms. — I'UJIMA, DAIJIRO in the *Bulletin de l'Association séricicole du Japon*, Year II, No 12, pp. 1-16. Tokio, December 25, 1917.

As it is not uncommon in Japan for the young mulberry leaves to suffer from drought and frost the author has sought for plants suitable for feeding silkworms while resisting frost (other than *Cudrania triloba* [silkworm thorn]; *Broussonetia Kazinoki* Sieb., black goat's-beard, dandelion, plants already known to be utilisable for this purpose).

The author lists 13 plants that seem to be eaten readily by the silkworm; he has classified them according to his experimental results in the following manner:

a) Plants of no practical value:— 1) *Phragmites communis* Trin.; 2) *Lactuca Thunbergii* Maxim; 3) *Campanula punctata* Mig.; 4) *Lampsana apogonoides* Maxim.; 5) *Lampsana humilis* Makino; 6) *Crepis japonica* Benth; 7) *Pieris hieracioides* L. var. *japonica* Bgl.

These plants might furnish good food but their leaves are too scanty.

b) Plants of uncertain practical value:— 8) *Lactuca denticulata* Maxim; 9) *Codonopsis lanceolata* B. and H.; 10) *Papaver somniferum*.

c) Plants fairly useful for feeding the larvae:— 11) *Sorghus oleraceus* L.; *Adenophora verticillata* Fisch. var. *typica*.

d) A plant worth using:— 13) *Lactuca brevirostris* Champ. (1). This plant starts growing early in spring and by autumn reaches a height of 6 or 7 ft. If it is cut in summer, it puts forth buds and grows rapidly, so that the leaves can be removed continuously from spring to autumn. Silk-

(1) See R., January 1918, No. 77. (Ed.).



worms fed on this plant until their first moult and even the second one, gave excellent results, actually better than those given by mulberry-fed larvae. Larvae fed on this plant up to the third moult gave results slightly inferior to the preceding ones; but experience has shown that *L. brevisrostris* is perfectly suitable for feeding silkworms.

675 - **Production of Silkworm Eggs of the Annual Breed, in Japan, in 1917.** — *Informazioni seriche*, Year V, No. 6, pp. 89-90. Rome, March 20, 1918.

According to the Japanese Ministry of Agriculture and Commerce the quantity of silkworm eggs produced in 1917 was estimated at 292 347 533 layings of eggs in frames and 765 050 boxes of commercial eggs, or a total of 3 688 525 boxes (100 layings in frames make a box), an increase of 5 % on the production for 1916.

The seed was produced by the different breeds in the following manner: 1 448 623 boxes of Japanese breeds, or 39.3 % of the total production; 2 239 902 boxes of foreign breeds, or 60.7 %. In the foreign races there were 3.5 % of yellow cocoons and 46.5 % of white ones. The Sino-European hybrid is the most numerous (58 %) in the eggs giving yellow cocoons; then come the Nippo-European hybrids with 17.7 % and the European races with 11.2 %. Amongst the eggs giving white cocoons, the Sino-Japanese hybrid forms 58.9 %, the Sino-Nippo-Europeans 15.9 % and the Chinese races 19.2 %.

676 - **Development of the Silkworm industry in Cambodia.** — DE FLACOURT, MARTIN, in *Bulletin Economique de l'Indochine*, Year XX, New Series, No. 127. pp. 649-661. Hanoi-Haiphong, November-December, 1917.

Cambodia has a hot and fairly dry climate and a fertile soil in which the mulberry tree grows remarkably well. Silkworm breeding there is very popular and very widely practised. Information gathered at the silkworm centres, as well as in certain other districts of the country, shows, not only the present possibilities of production, but also a great promise for the future development of the industry. Special attention should, therefore, be given to this country, which is perhaps the only one of French Indo China combining such conditions so favourable to an assured intensive development of silkworm breeding.

As things are at present its capacity of production makes it possible to consider with confidence a perfected spinning industry which will henceforth be assured of obtaining locally a sufficient quantity of good quality raw material to supply over 500 to 600 pans. The undeniable influence of the industry on the production of the country may be easily foreseen.

On the other hand the local Government, by the action it has exercised so far on the most important silkworm breeding centres and could extend to the other districts of Cambodia, and by the great encouragement it has given to the industry, has favoured and prepared the way for the establishment of steam silk spinning mills, which form the basis of a perfected silk industry, and appear at an eminently favourable moment.

It falls to private initiative and the French consumers to profit by the situation by founding spinning mills and thus contributing to the development of the local silk production

- FISH CULTURE 677 — **The Raising of Leather-Carp and Black-Bass in Sologne, France.** — ROULE, LOUIS, in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXVI, No. 2, pp. 33-35. Paris, February, 1918.

M. BRUNET has carried out successful acclimatisation experiments on his property at Mouteaux, Sologne.

Leather-carp (notable for their rapid growth, hardiness, small bones and good quality flesh) were imported from central Europe some 10 years ago. The acclimatisation was perfect, M. BRUNET has had no need for further importation and he now stocks his ponds with fry of his own rearing.

The black-bass (*Micropterus salmoides* Lac.) has been imported into Europe from the United States. It was known that it could live under French climatic conditions, but it was not certain if it could breed there, as it does in upper Italy. M. BRUNET imported 30 black-bass fry from Italy in April, 1914, and distributed them in his ponds; they were taken out in October 1914 and gave not only fine young fish weighing about 2.2 lbs., but also about 4 000 fry. The black-bass had reproduced, therefore, and were completely acclimatised.

## FARM ENGINEERING.

- AGRICULTURAL MACHINERY AND IMPLEMENTS 678 — **British Agricultural Tractors.** — *The Engineer*, Vol. CXXIV, Nos. 3233, 3234, 3235; Vol. CXXV, Nos. 3236, 3237, 3238, 3239, 3240, 3241, 54 Fig. London, December 14, 1917-February 8, 1918.

According to the President of the Board of Agriculture, 1 400 tractors had, by October 6, 1917, ploughed 14 500 acres of land for next year's harvest. Three years ago there were probably not 100 tractors in use in the United Kingdom. This progress, though considerable, has not been as rapid as it might have been owing to the objections raised by farmers against mechanical traction chiefly with regard to compressing the soil and the provision of inadequate power. In some recent models the latter defect is obviated by providing a 30 HP. engine which should suffice for 3-furrow ploughs doing fairly deep work under favourable circumstances. British tractors are usually strongly built, and they are therefore very lasting. In time, standardisation will be probably arrived at in the various types of tractors, but the final type has not yet been decided upon. There are still numerous problems that remain to be solved by British makers, who are at present occupied in delivering the machines that are required for bringing large areas under cultivation.

British agricultural tractors may be divided into 2 classes, those that are propelled by a) steam and b) by internal combustion engines. Contrary to the internal combustion engined machines, the steam driven ones follow, save in one or two cases, very closely the design of road locomotives, except they are lighter, the question of weight being of great importance.

STEAM TRACTORS. — The agricultural tractor made by AVELING & PORTER, of Rochester (fig. 1) resembles the road locomotives and rollers made by that firm, but it is smaller and lighter (5 tons). The driving wheels, which

are 5 ft. in diameter, are 12 in wide, but for working on soft ground detachable extension rings 6 in wide with the necessary spuds are provided.

The engine is of the compound type with 2 cylinders. The boiler has 27 tubes and is fitted with a fire-box of the Belpaire type. The normal speed of the engine is 225 revolutions per minute, and at that speed 21 brake-h.p. is developed at the fly-wheel. The engine is mounted on laminated steel springs fitted to both back and front axles. There are 2 speeds : — 2  $\frac{1}{2}$  and 5 miles per hour respectively.

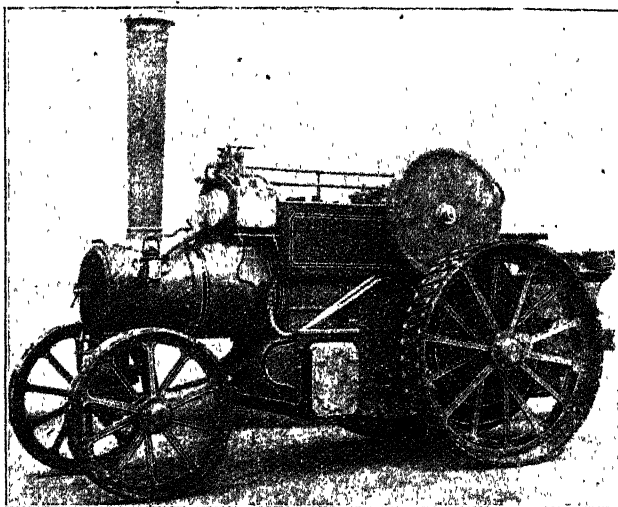


Fig. 1. — AVELING & PORTER steam tractor.

This serviceable little engine will haul a 3-furrow plough under normal conditions. It can cover from 40 to 50 miles per day on the road, with an approximate cost of from 15s. to 16s. Coal, or more preferably coke, is the fuel employed.

The tractor (fig. 2.) built by C. BURRELL & SONS, of Thetford, has an overall length of 14 ft. 3 in., a width of 5 ft. 8 in., and a height to the top of the fly-wheel of 6 ft. 8 in. ; it weighs 6 tons 18 cwt. The boiler is of the locomotive type and has 25 tubes. The engine is compound with cylinders 4  $\frac{1}{2}$  in. and 7  $\frac{1}{2}$  in. in diameter by 8  $\frac{1}{2}$  in. stroke. It runs at 230 revolutions per minute, developing 20 B. H.P. at the fly-wheel. It has either 2 or 3 speeds, the 3 speeds being 2, 3 and 5 miles per hour. The tractor is furnished with a winding drum which is operated by the engine and carries 60 yards of steel wire rope. It is specially built for farm work.

Amongst the various engines built by W. FOSTER & Co., of Lincoln, the 1909 model of the "Wellington" tractor, shown in Fig. 3. may be referred to.

The tractor is of 14-18 HP, very well built and designed, and can tow

an 8-ton load over good roads with gradients up to 1 in 20, while on the slow speed gear it will haul the same load up gradients of 1 in 8. The tender contains a water tank of 80 gall. capacity and a coal bunker holding 3  $\frac{1}{2}$  cwt.

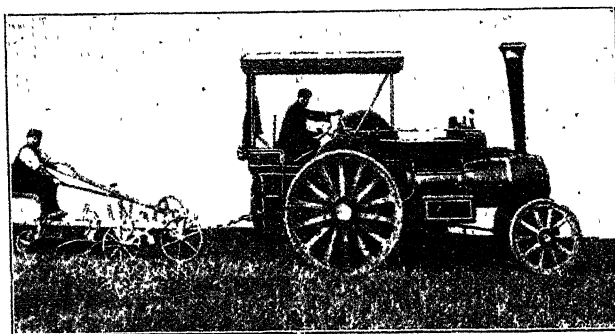


Fig. 2. — BURRELL & SONS steam tractor.

Additional tanks are fitted that bring up the total water capacity to 153 gall., which suffices for a journey of some 18 miles under normal conditions.

It is possible that, on account of the limitations of weight, the machine

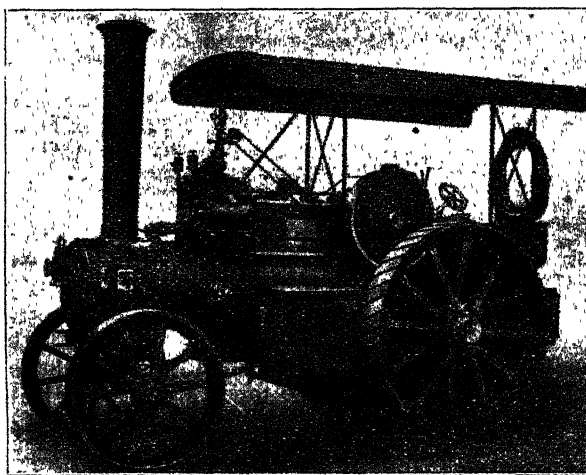


Fig. 3. — "Wellington" steam tractor (W. FOSTER & Co.)

requires replenishing with coal and water too frequently to suit farming conditions; the tractor has, however, been successfully used for hauling 3-furrow ploughs.

The same firm also builds a larger steam tractor, specially designed to

suit agricultural conditions in the Argentine. The boiler is designed for burning straw ; it will haul a plough, serve as a road tractor or drive a FOSTER threshing machine. The firm of FOSTER also builds a 40 B. H.P. petrol tractor for use as a general purpose machine. It weighs about  $4\frac{3}{4}$  tons and gives an effective draw-bar pull of 4 000 lb.

The "Suffolk Punch" steam tractor built by R. GARRETT & SONS, of Leiston, is of the horizontal compound type (1). It is intended to perform any agricultural work (Fig. 4) as well as hauling a 10-ton load at 5 miles an hour over fairly good roads. The fire-box is placed in the front of the motor, while the smoke-box and funnel are in the rear, so that the driver is very well placed for controlling the vehicle. The boiler is designed so that an inferior quality of coal may be used ; the steam is superheated. The engine develops from 37 to 40 B. H.P.

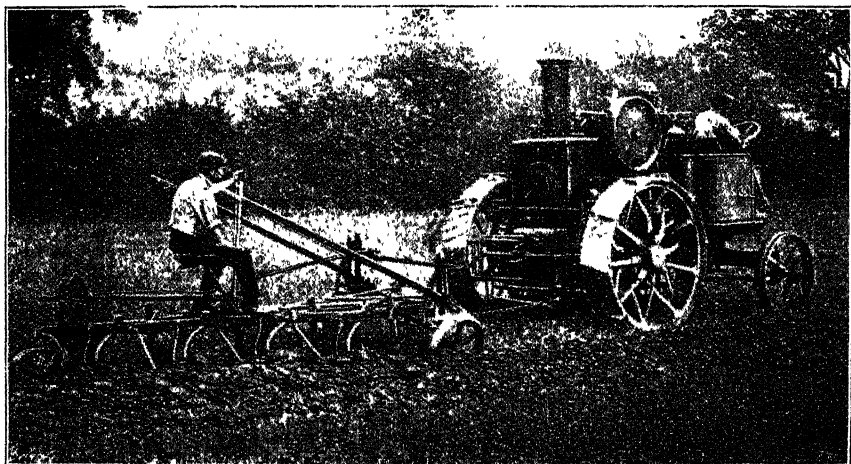


Fig. 4. — "Suffolk Punch" steam tractor (R. GARRETT & SONS) drawing a plough.

According to the makers, the average cost of hauling a 4-furrow plough, ploughing to a depth of 6 in. to 7 in., is from 3s. 6d. to 4d. 6d. per hour, the time taken being from  $1\frac{1}{2}$  to 2 hours per acre.

The engine normally runs at 325 revolutions per minute, and there are 2 speeds, namely, a slow speed of 2 miles per hour for ploughing and a higher speed of 5 miles for road work, the engine running at normal speed in both cases. The tractor in full working order weighs about  $5\frac{1}{2}$  tons.

The MANN'S PATENT STEAM CART AND WAGON CO., of Leeds, have designed a tractor specially for farm and estate work. This tractor (Fig. 5) has 3 speeds, varying from 2 to 6 miles per hour. The lowest speed is for ploughing in strong land ; the intermediate speed for light or medium

(1) See R., 1916, No 331. (Ed.).

land, as well as for pulling self-binders, etc., and the quick speed for travelling on the road.

The engine is of the horizontal type, with cylinders 4 in. and  $6\frac{3}{8}$  in. in diameter by 7 in. stroke. The governor is set to run the engine at 300 revolutions per minute, the speed required for driving ordinary threshing machines. The tractor itself weighs about  $4\frac{1}{4}$  tons, but detachable sideboards are provided so that an extra weight of about a ton can be carried for road work.

On ordinary roads this tractor can haul a 6-ton load; it will easily pull a 4-furrow plough in strong clay land. A fair average days' ploughing is 5 acres.

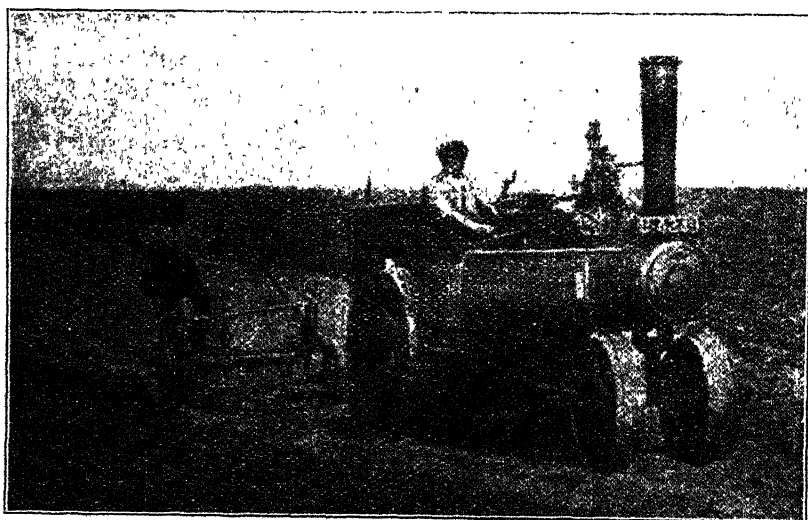


Fig. 5. — MANN steam tractor, drawing a plough.

In the tractor made by Messrs. J. and H. McLAREN, of Leeds (illustrated in Fig. 6), the boiler is of the usual traction engine type, with a compound engine, with cylinders  $4\frac{1}{2}$  in. and  $7\frac{1}{2}$  in. diameter by  $8\frac{1}{2}$  in. stroke. There are 3 speeds, namely, 5,  $2\frac{1}{2}$  and 2 miles per hour. When running on the road at 5 miles per hour the speed is 314 revolutions per minute, but when ploughing at 2 miles per hour, the speed is 355 revolutions per minute. The machine weighs under 5 tons and is built so as to have a long life. This tractor, provided with a trailer, gained the Royal Agricultural Society's Gold Medal in 1910.

The compound steam tractor made by RANSOMES, SIMS AND JEFFERIES, of Ipswich, weighs about  $4\frac{3}{4}$  tons. It is of the road locomotive type, and is more especially intended for hauling loads of from 5 to 7 tons on ordinary roads with moderate gradients than for ploughing and similar farm work. The high-pressure cylinder is  $4\frac{1}{2}$  in. in diameter and the low-pres-

sure cylinder  $7\frac{1}{2}$  in. in diameter, the stroke of both cylinders being 8 in. A by-pass is provided so that high-pressure steam can be admitted to the low-pressure cylinder to provide increased power for starting or emergencies. The engine develops 16-20 HP. For travelling, 2 speeds, namely, 3 and 5 miles per hour, are provided. The engine is mounted on helical springs to the main axle and laminated springs to the front axle.

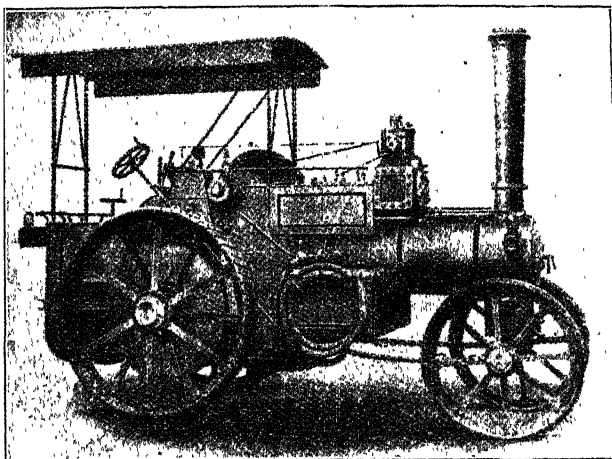


Fig. 6. — MACLAREN steam tractor.

The tractor made by ROBEY & CO, of Lincoln, can haul from 6 to 8 tons on ordinary roads, plough from 10 to 15 acres of average land per day of 10 hours and will drive such machinery as a 4 ft. 6 in. threshing machine.

It is of the usual road locomotive type, but in miniature (Fig. 7). The engine is compound with cylinders 5 in. and 8 in. in diameter by 9 in stroke. There are 2 travelling speeds, *i. e.*,  $2\frac{1}{2}$  and 5 miles per hour.

It is impossible to give any exact figures as to costs of working these tractors, but approximately it may be said that, taking coal at £2 per ton, the total cost (wages, fuel, oil, interest, etc.) of ploughing 60 acres in 5 days of 10 hours each is £12. 5. 6, the acre, therefore, costing 4s.  $1\frac{1}{2}d.$  per acre.

W. TASKER & SONS, of Andover, make a series of tractors specially designed for agricultural work. The most important model (Fig. 8) — the "Little Giant" — is a gear-driven steam-tractor; another type is chain driven. Another type has a winding drum for double engine ploughing.

These machines are of the road locomotive type. The engine is of the compound type with cylinders 5 in. and  $7\frac{3}{4}$  in. in diameter by 8 in. stroke, and develops 25 B. H.P. When the machine is to be used for driving fixed machinery, a high-speed governor of the Pickering type is provided. There are 2 speeds, *i. e.*, 3 and 6 miles an hour. The main gearing runs in an oil bath. The mounting is on the Hoare's spring system.

WALLIS & STEEVENS, of Basingstoke, make the "Wallis" steam motor tractor for universal service. The model (Fig. 9) has been greatly perfected since it was first produced in 1900. It can haul a 6-furrow plough in most soils, and on medium land as many as 9 furrows have been cut with it.

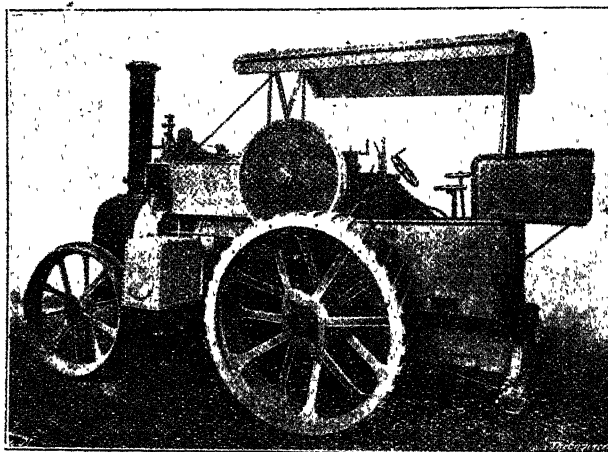


Fig. 7. — ROBEY & Co steam tractor.

The tractor has a locomotive-type boiler with the 2-cylinder engine mounted on top of it. When running at its normal speed of 400 revolutions per minute it develops 24 B. H.P. The working parts are enclosed in a

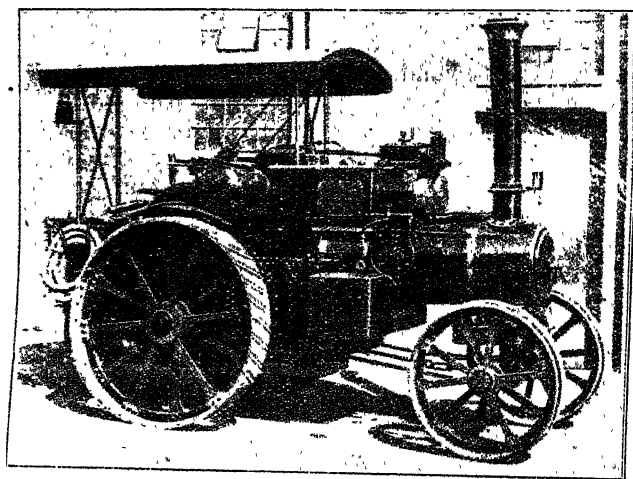


Fig. 8. — "Little Giant" steam tractor (W. TASKER & SONS).



splash oil-bath, and are therefore protected from dirt and dust, while being easily accessible to the driver. Gear changing is easy and the main axle is fitted with a differential motion. The hind axle is fitted with a slip-winding drum. The tender contains a coal bunker and a water tank. The tractor burns coal or coke, but wood may be used.

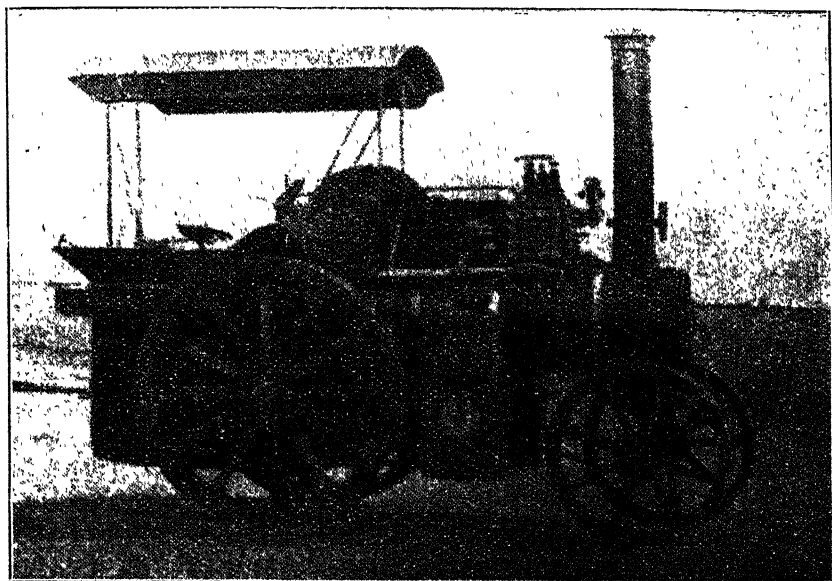


Fig. 9. — WALLIS & STEEVENS steam tractor.

According to the makers the cost of ploughing an acre works out at just under 11s., while the machine can plough 5 acres a day on the average.

INTERNAL COMBUSTION TRACTORS. — BUMSTED & CHANDLER, of Hedgesford, Staffordshire, make the "Ideal" (1) tractor (Fig. 10) for general farm use: — ploughing, harvesting, road hauling, and as a power plant.

It is driven by a vertical 4-cylinder engine, which develops 35 HP. There are 2 speeds forward of 3 and 6 miles per hour and a reverse speed of 3 miles per hour. The hind wheels are furnished with self-cleaning spuds. With a 4-furrow plough, the machine weighs 4  $\frac{1}{2}$  tons. It is 20 ft. long with the plough attached, and 6 ft. 6 in wide. On average land it ploughs one acre per hour.

A long and interesting description is given of the Crawley "Agrimotor", which has been dealt with previously (2).

Motor ploughs of two sizes are built by J. FOWLER & Co., of Leeds. In one the engine has a single cylinder, while in the other there are 2 cylinders.

(1) See B., 1914, No. 558. (Ed.) — (2) See R. 1917, No. 942. (Ed.)

These machines embody the Wyles' patents and also the subsequent inventions and improvements of J. FOWLER & Co. The first type, of 10 HP. (1), can do the work of 4 horses and is very suitable for work among drilled crops, vineyards, hop gardens, colonial crops, etc.

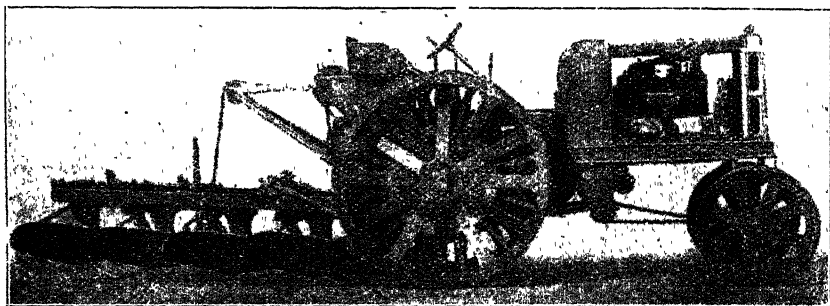


Fig. 10. — BUMSTEAD & CHANDLER motor tractor, hauling a plough.

The 2 cylinder plough (Fig. 11) with a single speed of  $1\frac{3}{4}$  miles per hour, weighs about 21 cwt. It can be fitted with 2 forward speeds of 2.2 and 1.5 miles per hour respectively, and a reverse speed of 1.5 miles per hour. It is slightly longer and wider than the single-cylinder machine.

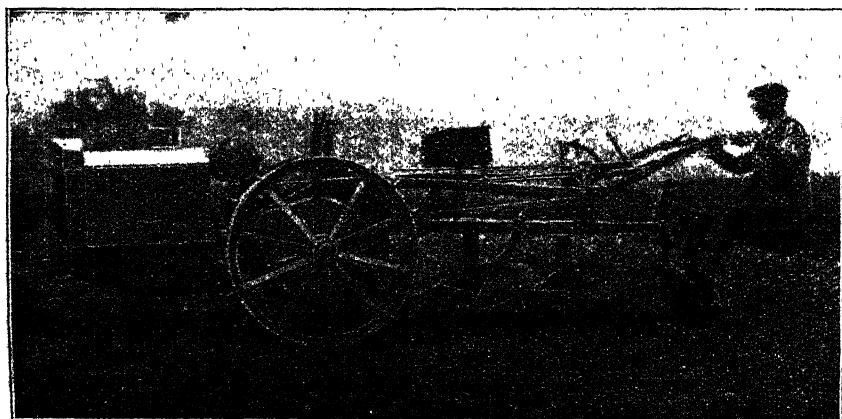


Fig. 11. — JOHN FOWLER & Co. motor plough.

Its cylinders have a 4 in. bore and 5 in. stroke; it develops 13-14 B. H. P., with the engine running at from 1 000 to 1 100 revolutions per minute.

It can either cut one or two furrows; if 2, the width and depth cut is slightly less.

(1) See *R.*, 1916, No. 897. (*Ed.*)

The "Ivel-Hart" tractor, built by the IVEL AGRICULTURAL MOTORS, Limited, is driven by an engine which will work with paraffin, petroleum and other low grade fuels, after starting on petrol. One of its chief features is (Fig. 12) that it only has one driving wheel, and hence differential gearing is not required.

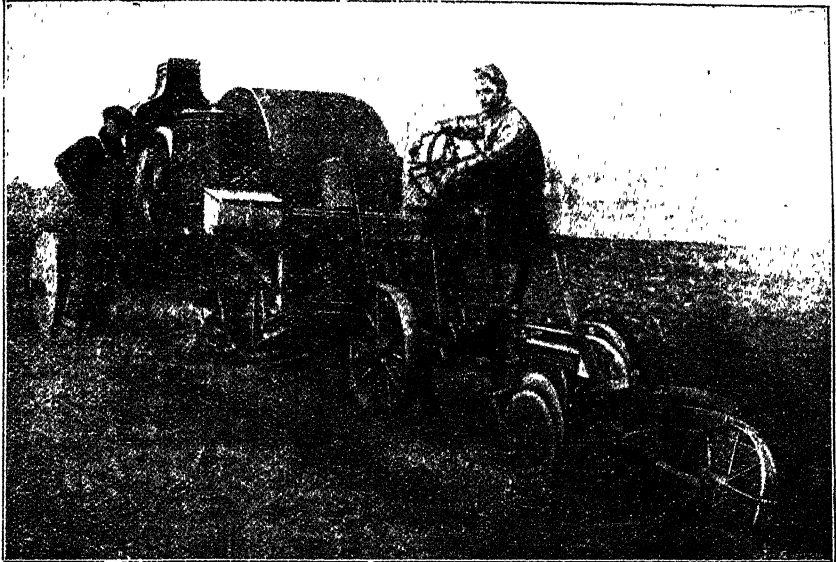


Fig. 12. — "Ivel Hart" motor tractor, drawing a plough.

The engine is of 2-cylinders, cast in one piece, with  $5\frac{1}{2}$  in. bore and 7 in. stroke, and the normal speed is 600 revolutions per minute (varying from 500-750). At the normal speed the brake horse-power is 22, and the draw-bar horse-power 15. There are 2 forward and 2 reverse speeds, obtained by a total of 7 gear wheels and pinions, 5 of which run in an oil bath. Lubrication is of the force feed type. The total weight is 59 cwt, and the length is 12 ft. 8 in.

The machine is self-steering when ploughing. The draw-bar can be adjusted in position. Under average conditions the tractor can haul a 3-furrow plough at a depth of from 6 in. to 8 in., while in heavy soils it will haul a 2-furrow plough cutting from 6 in. to 10 in. deep. It will plough an acre with a 3-furrow plough to a depth of from 6 in. to 7 in. in from  $1\frac{3}{4}$  to  $2\frac{1}{4}$  hours, depending on the nature of the soil and the length of the field. To plough an acre takes from 4 to 5 gallons of paraffin according to the soil.

The motor plough made by MARTIN'S CULTIVATOR COMPANY, Limited, of Stamford, is of the caterpillar type. It is a 3-furrow plough (Fig. 13) and

does all the work that can be done by horse ploughing ; it can be manipulated by one man.

It can plough 5 or 6 acres a day with a consumption of  $2\frac{1}{4}$  to 3 gall. of petrol. The whole of the plough frame can be detached and its place taken by a wheeled undercarriage, the machine then becoming an agricultural tractor suitable for working cultivators, drills, harrows, mowers, etc. A pulley for driving machinery can also be attached.

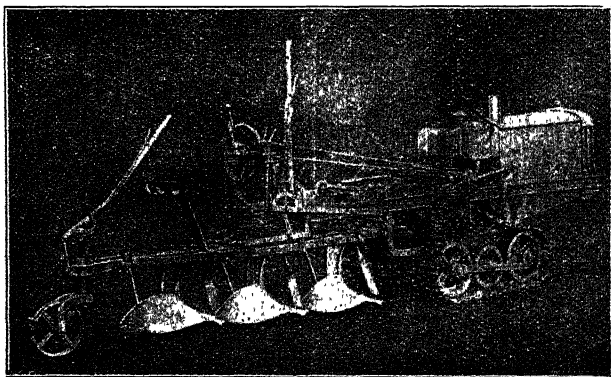


Fig. 13. — MARTIN motor tractor, drawing a plough.

The engine is of the 4-cylinder, 4-cycle type, similar to that used in heavy motor lorries. The cylinders have a bore of  $3\frac{3}{4}$  in and a stroke of 5 in. At 1000 revolutions per minute the engine develops 25 B.H.P. There are 2 "Zenith" carburettors. The engine is started on petrol and run on paraffin. There is a Dixie magneto and lubrication is effected by a gear-driven wheel pump.

The chain tracks are constructed in accordance with recent patents. Each can be separately adjusted so as to act as land or furrow wheels respectively and also to regulate the depth of ploughing. They distribute the weight over a large area of soil, and since the total weight of the motor with a 3-furrow plough is only about 30 cwt., the weight per unit of area in contact with the soil is by no means high.

The "Universal" tractor(1), made by the SAUNDERSON TRACTOR AND IMPLEMENT CO, is well known, but the present model (Fig. 14) is much more simple. The makers have paid great attention to the accessibility of the parts, ease of renewals and increase of bearing surfaces to give longer life. Before this improved model was placed on the market it was tested for 12 months on some of the heaviest clay in England. The machine proved itself capable of doing the entire work on a 240-acre farm, no horse labour whatever being required.

(1) See *B.*, 1914, No. 558, and *R.*, 1916, No. 897. (*Ed.*)

The "Universal" tractor is of 20-25 B.H.P. It can haul a 3 or 4-furrow plough or other implement, and drive a 4 ft. 6 in. thresher with elevator and chaff-cutter attached. It will haul 5 or 6 tons on the road at a speed of 5 miles per hour. By means of a special coupling it can haul 3 mowing machines, or 2 self-lift binders.

All the working part of the tractor are covered in; the control mechanism is very simple: the movement of one single lever in front of the driver forwards or backwards controls everything by acting on the governors. The tractor is completely standardised, so that the firm will soon be producing a large number of these British-built machines.

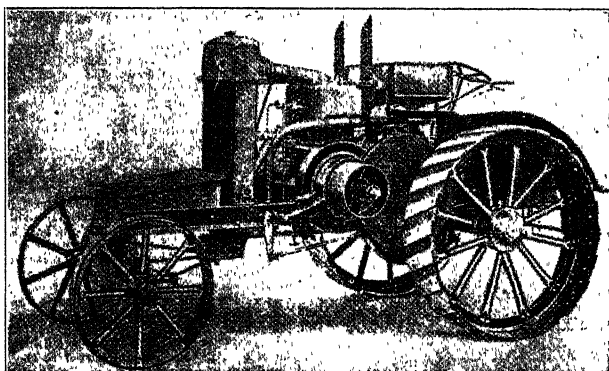


Fig. 11. — SAUNDERSON TRACTOR AND IMPLEMENT Co. motor plough.

With the object of providing an equipment less costly than the usual steam plant, WALSH & CLARK, of Guisely, near Leeds, make a ploughing set operating on the cable system, but driven by internal combustion engines, which are started on petrol but run on paraffin. Each engine (Fig. 15) weighs about 6 tons, and is rated at from 30 to 55 B.H.P. at an engine speed of 600 revolutions per minute, and when travelling or ploughing, and 22 B.H.P. on the driving belt.

The engine is of the horizontal type, with 2 cylinders, and gives a continuous pull on the rope of 3500 lb. It will haul a 4-furrow plough on medium or light land, and a 3-furrow plough on heavy land. A pair of engines can plough from 7 to 10 acres per day of 10 hours, according to the nature of the land, and with rope speeds of from 250 ft. to 350 ft. per minute. They will also cultivate from 14 to 20 acres per day. The machine can be employed as a tractor for road or field work.

Messrs. W. WEEKS & SON, of Maidstone, make the WEEKS DUNGEY "New Simplex" tractor (Fig. 16), intended for all-round farm work. It starts on petrol, but runs on paraffin; there are 3 speeds, *i. e.*, 4  $\frac{1}{2}$ , 2  $\frac{1}{2}$  and 1  $\frac{3}{4}$  miles per hour. It has cut 24 acres of corn per day with an ordinary 5 ft. binder, and 27 acres with a 6 ft. machine.

The "New Simplex" tractor has 4 wheels and weighs 35 cwt. It is 8 ft. long, 4 ft. wide and 5 ft. 6 in. high and develops 25 B.H.P.

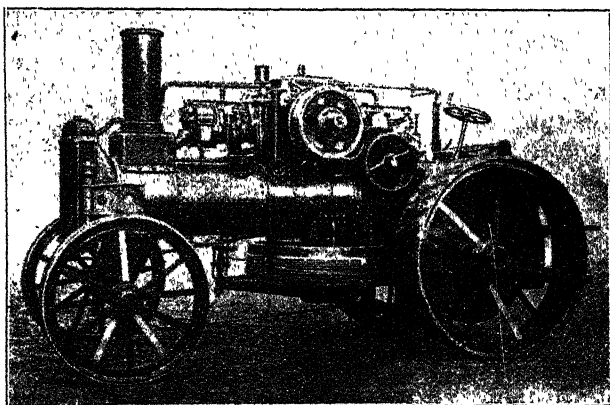


Fig. 15. — WALSH & CLARK cable motor tractor.

The machine is very well constructed and fitted with all the latest improvements. In Kent, it has ploughed from  $2\frac{1}{2}$  to 3 acres per day, at a cost of about 12s. per acre.

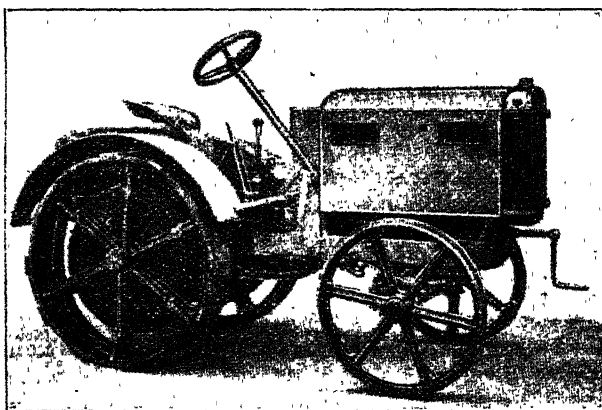


Fig. 16. --- "New Simplex" motor tractor (W. WEEKS & SON).

The WYLES motor plough has been described in this *Review*, March 1918, No. 332. Fig. 17 shows it hauling a mowing machine.

The latest tractor built by Messrs. CLAYTON & SHUTTLEWORTH, of Lincoln, is of the chain track type, and a woman can manipulate it, with a

plough attached. The tractor develops 35 HP and it can haul a 3- or 4-furrow plough.

The engine has 4 cylinders, each of 120 mm. bore and 140 mm. stroke. Petrol is used for starting and paraffin for running. The mechanism is easily accessible. Two forward speeds of  $1\frac{3}{4}$  and 4 miles per hour and a reverse of 3 miles per hour are provided, while the necessary mechanism is actuated by straight-through lever control. The chain tracks have received a good deal of attention. The weight of the tractor is carried on each side by 4 rollers.

The draw-bar pull is 2 tons in slow gear. For the driving of machinery there is a belt pulley. The tractor weighs 2 tons 16 cwt. It is 11 ft. long, 5 ft. 4 in. wide and 5 ft. 6 in. high. The British Government has ordered large numbers of these tractors.



Fig. 17. — WYLES motor tractor, hauling a plough.

The ALLDAYS & ONIONS PNEUMATIC ENGINEERING Co. make a tractor carried on special springs for road work, the springs being clamped down for field work.

Fig. 18. shows the tractor, which is for all-round work. It has 3 speeds forward and a reverse ; the highest road speed is 5 miles per hour and the slow speed is  $1\frac{1}{2}$  miles per hour for difficult ploughing and  $2\frac{1}{2}$  for ordinary ploughing.

The engine is vertical, 4-cylinder, and runs at 1000 revolutions per minute. A Zenith carburettor, arranged to work with paraffin is provided.

The "New Simplex" tractor has 4 wheels and weighs 35 cwt. It is 8 ft. long, 4 ft. wide and 5 ft. 6 in. high and develops 25 B.H.P.

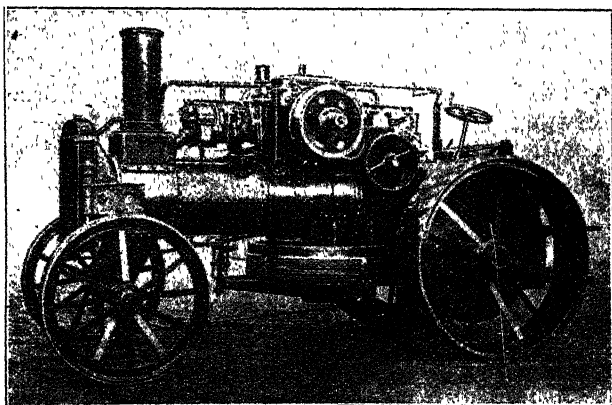


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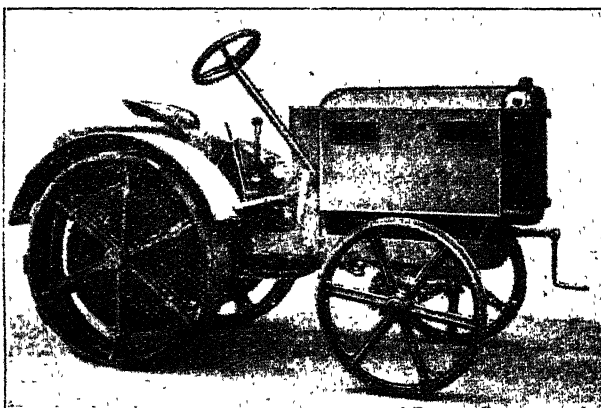


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The engine is vertical, 4-cylinder, and runs at 1000 revolutions per minute. A Zenith carburettor, arranged to work with paraffin is provided.

The crank shaft is carried in 3 bearings lined with anti-friction metal. There is a high-tension Dixie magneto, and steering is by the Ackermann system. The tractor will turn in a circle having a diameter of 28 ft. It is provided with a winding drum, carrying 50 yards of steel wire rope. The present wheel base of the tractor is 7 ft. 10 in., but it is to be reduced to 7 ft.

The tractor has been tested in Scotland and also at Birmingham where it drew a 3-furrow HOWARD gang plough. The draw-bar pull was about 1100 lb. on the average.

For use in driving machinery, an 18 in. pulley is provided; it can drive a 4 ft. 6 in. threshing machine.

Besides the detailed description of the various British tractors, an account is given of the "Tracford" (1) appliance, intended to convert a FORD or other car into a 20 HP agricultural tractor. There are 3 steel land wheels, provided with detachable spuds.

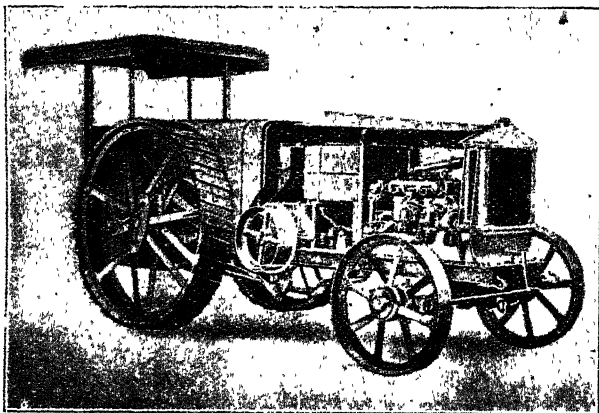


Fig. 18. — ALLDAYS & ONIONS motor tractor.

679 — **Ploughing with Government Tractors in England.** — *Mark Lane Express Agricultural Journal*, Vol. CXIX, No. 4507, p. 141, and No. 4510, p. 228. London, February 11 and March 4, 1918.

In Herefordshire, 3 "Titan" tractor units ploughed over 520 acres in the last week of January, the division being: Hereford, 170 acres; Leominster, 142 acres, and Ross, 208 acres.

The Ross team's work, which was accomplished with 7 tractors, gave an average of  $29 \frac{5}{7}$  acres per tractor; 9 tractors were used in the Hereford and Leominster units, which makes the work done by the Ross unit all the more creditable; the work done by the Ross tractors varied from 26 to 32 acres each, ploughed in from 53 to  $68 \frac{1}{2}$  hours.

(1) See R., April 1918, No. 455. (Ed.)

In Surrey, a Titan tractor ploughed 51 acres in a single week at Redhill. The county average for the week was 12 acres per tractor.

In Lancashire a tractor towing a 3-furrow RANSOME plough did 52  $\frac{1}{4}$  acres during the week ended February 23. No special provision was made for record breaking. The ploughing was 8 in. deep and 2.54 gallons of fuel were consumed per acre.

In 5 weeks this tractor has performed the following work (including that described above): — during the week ended January 25, 27  $\frac{1}{2}$  acres were ploughed, 103 gall. of fuel; from January 25 to February 15, 21 acres were ploughed on an average per week, with an average consumption of 66 gall. of paraffin; the total consumption for the week February 15 to 22 for ploughing 52  $\frac{1}{4}$  acres was 133 gallons.

680 — **The Use of Coal Gas for Ploughing Tractors.** — *The Implement and Machinery Review*, Vol. XLIII, No. 516, p. 1289 + 2 Figs. London, April 1, 1918.

As petrol is unobtainable and paraffin is both scarce and costly, it is of interest to note the use of coal gas for ploughing tractors.

Messrs. BARTON BROS, of Beeston, England, make a flexible gas container to be placed above the tractor. This system, already adopted for many commercial and pleasure vehicles, is the most economical as it does not require the gas to be compressed and only gives a slight loss in calorific efficiency. For farm work there is no objection to the use of a container, save that of its voluminous appearance. It is carried on a tray supported by wooden uprights bolted on to the tractor frame.

The container's capacity is 250 cu. ft., and, it is reported that 500 cu. ft. of gas suffice to plough half an acre of level land.

The system can be employed to advantage by farmers within reasonable distance of a supply station. In England, as the companies usually give special conditions to users of gas for power purposes, the cost of ploughing by this means is very low. In the case mentioned in the article the container is mounted over a Whiting-Bull tractor and the gas is brought to the field in a portable holder carried on a trailer and containing sufficient to charge the bag on the tractor three times, or enough to plough about three-quarters of an acre. To the cost of the gas must, therefore, be added the expense of the journeys with trailer between the field and the supply station.

The distance over which the owner can afford to transport the gas will probably be found to be fairly large considering the present price of other fuels.

681 — **Ridger for Making Irrigation Levees.** — See No. 623 of this *Review*.

682 — **Review of Patents.**

TILLAGE MACHINES AND IMPLEMENTS. — *France*: 486337 Fixing device, for plough shares and other similar cultivating tools; 486445 Motor plough.

*United Kingdom*: 113029 Motor driven endless track machine for levelling ground and for extracting steel and iron scrap therefrom in view of reclaiming land.

*United States* : 1254817 Harrow ; 1254985 Plough coulter ; 1255035 Self cleaning harrow and cultivator ; 1255420 Combined tractor, roller and harrow ; 1255442 Detachable share for cultivator and scarifier implements ; 1255509. One wheel harrow cart ; 1256225 Detachable V shaped packing band for fitting on a harrow-disc ; 1256349 Traction gang plough ; 1256632 Agricultural machine ; 1256984 Disc-plough ; 1257127 - 1257818 Ploughs ; 1257236 Tractor plough ; 1257407 Riding attachment for harrows and the like ; 1257446 Gang plough.

MANURES AND MANURE DISTRIBUTORS. — *United States* : 1255052 Straw-spreader ; 1256190 Spreading machine ; 1256196 Straw conveyor and spreader ; 1256854 Fertilizer distributor ; 1256459 Fertilizer attachment for maize planters.

DRILLS AND SEEDING MACHINES. — *Canada* : 180769 Land packer and seeder.

*United Kingdom* : 112976 Potato planter.

*United States* : 1254859 Drill ; 1255055 planter ; 1255532 marker for maize planter ; 1256083 Rotary marker device for actuating the rock shaft of a maize planter ; 1256292 Potato planter ; 1257839 Maize planter ; 1257928 Attachment for maize planter.

VARIOUS CULTURAL OPERATIONS. — *United States* : 1254687 Weeder ; 1254999 Cotton chopper ; 1256473 Cultivator fender.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *France* : 486296 Application of calcium sulphide to the treatment of fungous diseases of the vine and other plants.

*United Kingdom* : 113121 Reciprocating pump for spraying apparatus.

*United States* : 1254649 Boll weevil exterminator ; 1255131 Insect destroyer.

REAPERS, MOWERS AND HARVESTING MACHINES. — *France*. 486230 Circular platform harvesting machine with curved cutting knife for various heights.

*United Kingdom* : 113117 Mechanism of side-delivery rake and swath turning machines.

*United States* : 1255209 Combined harvester ; 1255365 Hay sweep ; 1255520 Hay rake ; 1255914 Pea picker ; 1255930 Harvester and elevator combined ; 1255982 Harvester-crop curing chamber and baler ; 1256178 Side-delivery rake ; 1256347 Maize harvester ; 1256390 Vegetable gatherer and loader ; 1256410 Bundle carrier attachment for harvester ; 1256438 Vacuum cotton picking machine ; 1256683 - 1247403 Ensilage harvesters ; 1256700 Grass guard for mowers ; 1256776 Corn harvesting attachment for farm wagon ; 1257269 Bean harvester ; 1257304 Adjusting mechanism for grain shocking machine ; 1257386 - 1257387 Mowers.

MACHINES FOR LIFTING ROOT CROPS. — *Switzerland* : 77479 Forkhead for potato diggers.

*United States* : 1255051-1256713 Vegetable harvesters ; 1255302-1256182 Potato digging machines ; 1256119 Front auger support and bearing for beet harvester ; 1257081 Beet harvester and topping machine ; 1257168 - 1257953 Beet harvesters.

THRESHING AND WINNOWER MACHINES. — *Canada*: 181020 Grain grader.

*United States*. 1254817 - 1257592 - 1257802 Threshing machines; 1256120 - 1256506 Feeders for threshing machines; 1256585 Bean separator; 1257115 Pea and bean separator.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada*: 181041 Drying kiln.

*United States*: 1255041 Hay press; 1257466 - 1257474 Bale forming presses; 1257510 Feeding device for hay baling presses.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *Canada*: 181061 Tractor.

*France*: 486455 Agricultural tractor.

*United Kingdom*: 113016 Apparatus for power cultivation of land; 113102 Endless track vehicle.

*United States*: 1254819 Endless automatic track laying and ground treading power operated traction engine; 1255404 - 1255530 - 1256651 Tractors; 1256113 Tractor wheel; 1257416 Tractor or truck; 1257589 Tractor connection.

FEEDING OF LIVESTOCK. — *United States*: 1254937 Hog watering apparatus.

POULTRY FARMING. — *United Kingdom*: 113159 Feeding trough for poultry.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *United Kingdom*: 113042 Bakers' oven.

DAIRYING. — *Canada*: 180828-180970 Desiccated milk; 180829-180830 Milk condensation, process and apparatus; 180831 Buttermilk powder; 181131 Milk concentrating apparatus; 181133 Process of condensing and desiccating buttermilk; 181134 Condensed buttermilk.

*Switzerland*: 77531 Churn mechanism; 77532 Milk skimming device.

*United States*: 1255186 Milking machine cluster; 1255239 - 1256793 Milking machines.

VARIOUS. — *Switzerland*: 77478 Hydro-electrical installation for operating agricultural machinery.

*United Kingdom*: 112987 Humidifier.

*United States*: 1255055 Hydraulic pump.

## RURAL ECONOMICS.

683 - **Organization of Ten Dairy Farms in the Bluegrass Region of Kentucky.** — ARNOLD, J. H., in *U. S. Department of Agriculture Bulletin* No. 548, (Office of Farm Management), pp. 1-12. Washington, D. C., May 24, 1917.

This bulletin presents a brief analysis of the organization of 10 dairy farms selected and studied during 1914 in Mason, Scott and Madison Counties, in the bluegrass region of Kentucky.

The adaptation of the soil to bluegrass pasture is the distinctive natural advantage which these localities have for this type of farming. The

climatic factors, however, partly offset this advantage, especially for the production of cheese and butter. The long summer months are warm, with a lower rainfall than the winter months, while in the extensive dairy sections of Wisconsin and New York the highest rainfall is during the summer months which average 7 to 8 degrees F. cooler than in Kentucky. These adverse conditions have not interfered with the increased production of market milk where there is a demand at good prices, but they are a handicap, especially in the production of cheese, which is produced to best advantage in a climate that is relatively cool.

*Receipts from Dairy Products, together with Labour Incomes of Each of Ten Farms.*—The business of each of the 10 farms studied may be summarized briefly as follows:—

TABLE I. — *Size of farms, with number of cows and with receipts from labour income and dairy products.*

Farm No.	Size of farm acres	Number of cows	Labour Income	Gross receipts from milk	Receipts from cream	Receipts from butter	Gross receipts per cow	Receipts from dairy	Receipts from tobacco
1 . . .	400	75	\$ 1 466	\$ 5 315	\$ 2101	—	\$ 98.88	% 80	% 10
2 . . .	290	30	3 654	4 500	—	—	150.00	67	13
3 . . .	247	19	1 739	3 066	730	—	199.78	82	2
4 . . .	150	50	6 408	6 768	1128	\$ 25	158.00	72	0
5 . . .	51	15	3 201	2 920	225	260	227.00	85	9
6 . . .	86	9	1 121	76	1996	—	230.00	80	9
7 . . .	82	30	1 509	2 966	480	—	114.86	90	0
8 . . .	70	4	— 130	—	208	—	52.00	55	0
9 . . .	134	12	287	—	624	—	52.00	49	15
10 . . .	120	12	— 1 521	—	104	780	73.60	51	0
Total Average	163	27	* 1 773	2 561	689	106	126.16	71	5.8

The market price of milk distributed to customers ranged from 7 to 10 cents per quart, and cream 60 cents to \$ 1 per gallon. When the milk was re-tailed in larger cities through local distributors the farmer received 15 to 20 cents per gallon and paid 1 ½ to 2 cents per gallon to ship it 30 to 50 miles.

The labour incomes on most of the farms were large as compared with those of successful farms of other types in this region. The average labour income on 187 farms was \$ 750, while the average of these ten dairy farms was \$ 1 773. On the ten farms studied those which sold market milk and which had high receipts per cow made the largest labour income.

*Seven Successful Dairy Farms Analyzed and Compared.* Table II shows the capital invested and the receipts and expenses on seven successful dairy farms.

TABLE II. — *Seven Successful Dairy Farms Analysed and Compared.*

	Farm 1	Farm 2	Farm 3	Farm 4	Farm 5	Farm 6	Farm 7
Size of farm (acres) . . . . .	400	290	247	150	51	86	82
Number of cows . . . . .	75	30	19	50	15	9	30
Number of other animal units (1) . . . . .	37	28	16	48	11	33	30
Total capital (2) . . . . .	\$ 50 097	26 890	15 396	33 081	8 843	16 800	13 661
Working capital (3) . . . . .	7 874	6 881	3 046	11 354	2 786	2 675	3 396
Tenant's capital . . . . .	—	—	—	—	—	—	1 698
Total receipts . . . . .	11 824	8 383	5 105	12 500	5 449	2 982	5 134
Receipts from dairy . . . . .	7 416	4 500	3 796	7 921	3 405	2 072	3 446
Expenses (4) . . . . .	7 854	3 385	4 438	2 818	1 811	1 021	2 032
Farm income (5) . . . . .	3 970	4 998	2 509	8 062	3 638	1 961	3 102
Tenant's farm income . . . . .	—	—	—	—	—	—	1 594
Labour income (6) . . . . .	1 466	3 654	1 739	6 408	3 196	1 121	1 509
Owner's profit on investment . . . . .	—	—	—	—	—	—	12.6%

(1) Animal unit — the equivalent of 1 cow, horse, or beef animal; 2 heifers, 4 calves, 7 sheep, 5 hogs, 14 pigs, or 100 chickens are counted as equivalent to an animal unit.

(2) Total capital includes investment in land, buildings, machinery, live stock, feed supplies, and cash to run the business.

(3) Working capital includes all items of capital except land, buildings, and other improvements usually included in real estate.

(4) Expenses include a charge for unpaid family labour, depreciation, and 5 per cent interest on total capital besides money actually paid out in conducting the farm business.

(5) Farm income is the total receipts less expenses.

(6) Labour income is farm income less 5 per cent interest on invested capital.

Farm 1 is the largest of the ten in question and is valued at \$ 125 per acre. It is well situated near a market point. While it is somewhat rolling the soil is of good quality and nearly all of it tillable. If properly organized, this farm should have made the largest labour income of the group; instead it is among the lowest of those which were only fairly successful. In the first place receipts per cow are low as compared with those of the more successful farms. Half this acreage could easily be made to support this herd. With a higher degree of diversity and by handling other live stock, the gross income of this farm should be increased considerably without much more expense. The average expenses of the ten farms are about 45 per cent. of the receipts, while on this farm they are about 75 %, showing that the business was too expensive for the income received. This farmer housed his cows in a \$ 7 000 dairy barn, an investment of nearly \$ 100 per cow, while his nearest competitor, one of the most successful farmers of the group, had but one third of this amount invested. This farm, although large, failed to produce as much feed for dairy stock as the average farm (\$ 18) and expended for purchased feeds \$ 20 per cow.

Farm 2 is one of the most efficiently organized larger sized farms. The diversity is much larger than that of farm No. 1. About 46 per cent of the receipts were from sources other than dairying, mainly wheat and tobacco. Sales of live stock amounted to \$ 1 200 above purchases.

The operator owned 132 acres and rented 158 additional ones for which he paid \$ 800 a year. All the feed except concentrates was raised on the farm. Only one man was hired, the operator and his family doing most of the dairy work; 33 acres of maize for grain, 12 acres of silage maize, 50 acres of wheat, 25 acres of meadow hay and 5 acres of tobacco were raised, by his own and hired labour; 11 acres of tobacco and 10 acres of maize were raised by a cropper.

Farm 3 had 10 acres of maize for grain, 8 acres for silage, 10 acres in rye which was grazed, and 20 acres in hay. There were 153 acres in pasture, 2 acres in garden and orchard, and the remainder, 44 acres, was considered waste land. The topography was hilly and not well adapted to cultivated crops. The land was valued at \$ 40 per acre, though the more level land in the community was valued at \$ 100 to \$ 150 per acre. Three year-hands were employed on this farm and seven head of work stock were kept. Both man-labour and horse-labour were poorly utilized. A better utilization could have been achieved and the income considerably increased if a few acres of tobacco had been raised. There were no receipts from crops and diversity was low.

Farm 4 may be classed as the best dairy farm of the ten. While the receipts per cow were considerably above the average, others had higher receipts per cow, but in the expenses this farm showed high efficiency in the economy of the labour and feed, two most important factors. Operating expenses were only about 35 per cent of receipts as compared with 45 per cent, the average for the ten farms. The land area (150 acres) was small as compared with the number of stock units kept on the farm. These numbered 98, or about 1.9 acres for each animal unit. Of this number of animal units 50 were dairy cows. The food purchased amounted to about \$ 10 per cow. About 50 per cent of the farm area is in bluegrass pasture. About \$ 1 000 of the total receipts represented breeding fees. During the last two years (1915-1916) hemp has been substituted for tobacco, and yields 1 700 lbs per acre which, at 10 cents per pound, represents \$ 170 per acre. The expense of growing an acre of hemp is about the same as that of tobacco (\$ 50 to \$ 60 exclusive of rent), and the average rent for the land is figured at \$ 30 to \$ 50 per acre. This farm, operated by a graduate of an agricultural college, is rated among the best dairy farms in the State. The work of milking, bottling and distributing is done by the operator with the help of a man and a boy.

Farm 5 shows the possibility of profitable dairying on a small farm with a small amount of capital invested on which almost all the labour is done by the operator and his family. Operating expenses were but 33 % of receipts and the labour income was among the highest of the group. The receipts per cow were unusually high and allowed an expense of \$ 25 per cow for purchased feed. This farm produced \$ 500 of tobacco on 3 ½ acres, \$ 80 of poultry and \$ 115 of increase in value on colts raised. The farmer owns 40 acres and rents 11 acres in addition for hay; 25 acres are devoted to permanent bluegrass pasture.

Farm 6 was only moderately successful. Profits could have been in-



creased greatly if the business had been made larger by increasing the income from cows. If the operator had hired a man he could have increased his herd to 20 or 25 cows and besides could have raised 5 to 6 acres of tobacco instead of 2. There were no receipts from hogs and only \$75 worth of skim milk was sold.

Farm 7 was operated by a tenant who had a half interest in the working capital of the farm. Business expenses were shared equally, as were also receipts. The tenant with the help of two year-hands and some extra labour, performed the work; 45 acres of the farm were in maize for silage, 33 acres in pasture, 2 acres waste and 1 acre for garden. Receipts from sources other than dairy cows were mainly from young stock. There were no receipts from crops.

*The Farms that Failed.* — The three unprofitable farms of the ten were inefficiently organized and operated. Apparently these farmers depended mainly on dairy products for an income, but each was operating a small-sized business on a fair-sized farm. It does not pay a farmer to give special attention to the dairy business unless there is a sufficient number of cows to warrant special equipment, the application of most of his time, and the development and maintenance of a profitable market.

*Comparison of the Seven More Successful Dairy Farms with the Average of Ten.*—Table III compares the average of the seven successful dairy farms with the average of the whole group, with respect to the more essential factors.

*Comparison of the Seven More Successful Dairy Farms with  
the Average of Ten.*

		Average of 10 farms	Average of 7 successful farms
<i>Distribution of crops:</i>			
Average size of farms. . . . .	acres	163	187
In crops. . . . .	"	66	70
In pasture. . . . .	"	76	100
In maize for grain. . . . .	"	15	10
In maize for silage. . . . .	"	13	16
In meadow. . . . .	"	13	15
In wheat. . . . .	"	16	20
In tobacco. . . . .	"	5	6
In miscellaneous. . . . .	"	4	3
<i>Distribution of live stock:</i>			
Dairy cows. . . . .	number	27	40
Young stock. . . . .	"	21	16
Swine. . . . .	"	29	25
Poultry. . . . .	"	184	183
<i>Distribution of capital:</i>			
Total capital invested. . . . .	\$	22 552	23 662
Total working capital. . . . .		4 764	5 286
Machinery. . . . .		711	771
Investment in live stock. . . . .		3 291	3 699
Cash to run farm. . . . .		405	420
Feed and supplies. . . . .		355	366

	Average of 10 farms	Average of 7 successful farms
<i>Distribution of receipts:</i>		
Live stock products, . . . . .	\$ 3 554	\$ 4 610
Live stock inventory and sales . .	1 018	1 035
Crop receipts, . . . . .	589	813
Miscellaneous, . . . . .	120	235
	<hr/> 5 301	<hr/> 6 693
<i>Profits:</i>		
Receipts per cow . . . . .	\$ 126	\$ 164
Average farm income . . . . .	3 149	4 266
Average labour income . . . . .	1 773	2 954
	<hr/> Per cent, net earnings on investment	<hr/> 10
		14

These comparisons illustrate many of the points discussed for the different farms. For instance, the average successful farm had the largest business, as shown by the size of farm, the number of dairy cows, and the working capital. On the average successful farm there were more receipts from crops and miscellaneous sources than were shown for the average of the ten farms. The most important comparison is that shown for the receipts per cow: \$ 164 on the average of the successful farms and \$ 126 on the average of the whole group.

### AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDENT  
ON PLANT  
PRODUCTS

684 - **Wine Making With Foxy Grapes** (1) — CADORET, ARTHUR, in *Le Progrès agricole et viticole*, Year XXXV, No. 12, pp. 274-275. Montpellier, March 24, 1918.

A method is described (derived from the work of the late Prof. BOUFFARD and of PIERRE ANDIEUX and used for about 15 years by an agricultural syndicate) by which the foxy flavour of Clinton wine may be removed. The process consists of: —

- 1) harvesting shortly before complete maturity;
- 2) fermentation for 24 hours;
- 3) treatment with 9 gm. of sulphite for red wines;
- 4) strengthening for 2 or 3 days.

The method is still more satisfactory if the selected or natural yeasts of the country are utilised in combination with the sulphurous acid.

Quite recently the author obtained good results with Noah grapes which had not been treated in the vat by the following method: —

- 1) treatment with 1 % of oil;
- 2) repeated stirring for 48 hours;
- 3) decanting;
- 4) filtration through wood charcoal;
- 5) clarifying with 1 % unskimmed milk.

He intends to adopt the first method with his Noah grapes at the next harvest, and believes he will thus free them from all foxy flavour.

(1) Cf. R. May, 1916, No. 555 and Feb., 1917, No. 183. (Ed.)

685 — **Cupreous White Wines with Extreme Delayed Thickening.** — CARLES, P., in the *Annales des Falsifications et des Fraudes*, Year XI, No III-III, pp. 43-48 Paris, January-February, 1918.

For about twelve years there have been brought from time to time to oenological chemists, white wines of strange appearance, bad keeping qualities and, sometimes, doubtful hygienic value. These wines show nothing abnormal during the time they are treated as usual in the casks, but turn leaden when bottled, then become gradually thicker till they are eventually unsaleable. The rate of the thickening ("louche") varies according to the season and the composition of the wine, and is more rapid in proportion as the weather is hotter and there is less air between the liquid and the cork. Thickening stops suddenly when the wine come into contact with the air by being poured into a cooler, or if a few drops of hydrogen peroxide are added, and may be stopped from one day to another simply by removing the cork and leaving the bottle standing up. If the wine is poured back into a corked bottle the thickness reappears, though, beyond a certain limit, this re-starting is no longer possible. These phenomena are obviously due to a chemical reducing agent and an oxidising agent both acting on an unknown factor the proportions of which are minimum, as is very evident.

Wines behaving in this manner have the ordinary composition of white wines, but contain a few grams of fruit sugar, and are relatively rich in sulphurous acid; they are white wines sweetened by a sweeter one or with sugar and treated with sulphurous acid (anti-ferment). It is the small amount of sugar which is the principal reducing agent.

The unknown factor is copper, and the precipitate is red oxide of copper, caused by reduction by the grape sugar and sulphurous acid. There is no doubt that at least part of this copper comes from anti-cryptogamic sprays the bases of which are copper salts. Wines subjected to mutage contain very little tannin and their degree of acidity, sugar content and newness, in general, do not help to free them from metals. They thus take up the copper with which the grapes have been treated and keep it to an excessive extent.

There are many ways of testing whether white wines will thicken late. The method given is based on the capacity of tannin to make the copper dissolved in the wine insoluble and the capacity casein then has to remove the copper tannate in the lees.

Into 1 litre of wine is poured 1 cc. of  $\frac{1}{10}$  clear solution of tannin, or 0.10 gm. The whole is mixed and, after a few minutes, 10 cc. of skim milk are added (or, per hectolitre, 10 gm. of pure tannin and 1 litre of skim milk at the most). The mixture is well shaken, left for at least 24 hrs., then filtered. If copper is present it is contained in the deposit. The liquid is filtered, air-dried, and burnt. It is easy to dissolve everything in the ash with hydrochloric acid and to separate the copper by simply filtering with an excess of ammonia. The estimations may be made electrolytically or colorimetrically, since the original quantity was 1 litre.

In order to make sure that the treated wine no longer contains copper the clarified litre is evaporated in a porcelain dish, a little acid magnesium

nitrate added, and the residue burnt ; this may be done easily and completely with successive additions of fresh dilute nitric acid. It is essential to burn even the very smallest particles of carbon. The process is then continued as described above with hydrochloric acid, ammonia in excess, etc., or by any other method for separating copper from an inorganic mixture.

From an hygienic point of view, the amount of crystallised copper sulphate contained in such wines — according to the author, 0.015 gm. per litre — if taken at meals by healthy adults is not injurious to the health, but may be so if drunk between meal times. Invalids, old people and those suffering from liver complaints should not use these wines as a daily drink, the more so as similar quantities of copper may be contained in certain chocolates and even in native dwarf beans. In such cases, however, the consumption in weight of food is less than in the case of wine, and the food is not taken daily, with all meals, and between meals, as is wine. Finally there is no doubt that, by passing through the roots of the cacao tree and bean plant, the copper has been made innocuous, but this is not so with wines because the greater part of the copper has been deposited on the grape in the form of copper mixture and is found in this state in the must.

686 — **The Mycoderms of Wine.** — DE ROSSI, G., in *Le Stazioni sperimentali agrarie italiane*, Vol. IV, Pt. 11-12, pp. 529-562, Bibliography of 20 publications, 2 Pl. with 15 Fig. Modena, 1917.

The author has found at least 4 different species of mycoderms capable of acidifying wine, each with clearly different physiological aptitudes. These species are : — *Mycoderma vini*, which causes a very weak consumption of both the alcohol and the total acidity of the wine, while it does not produce volatile acids in sufficient quantity to influence the organoleptic properties ; *M. acidificans* which produces a large amount of volatile acids and thus even seriously changes the wine ; it ceases growth at 32-33° C. ; *M. duplex* and *M. tenax*, much more suited than the others to live in an acid medium, attack the acids very actively at a temperature above 15° C., but not destroying the alcohol vigorously ; *M. duplex* grows well in the presence of 9-10 % alcohol ; *M. tenax*, on the contrary, cannot support more than 4 to 5 % of alcohol.

687 — **Cement Vats.** — MATHIEU, L., in the *Revue de Viticulture*, Year XXV, Vol. XLVIII, No. 1241, pp. 230-233. Paris, April 11, 1918.

Owing to the war there is a shortage of casks, and it has been necessary to use all sorts of second-hand barrels, which sometimes give the wine a foreign taste ; in some cases cement vats are used and the question has arisen as to whether such vats are as serviceable as those of wood. The vat may be used for two distinct purposes — for fermentation, in which case the wine only remains in it during the process, or for storing the wine.

The material of which the sides are made, if well fired, can have no influence even on the finest wines, during the few days fermentation lasts.

For keeping wine, however, the wood is of great importance, so much so that for certain choice wines new oak of good quality is absolutely necessary for the long fermentation of white wines and for keeping the wine

after the first tunning. New oak imparts to the wine a taste due to its soluble substances, so that the use of choice oak has become necessary, as it is also for refining the alcohols of wine.

Oak chips, which would give up their useful substances, can be added to wine in a cement vat. Small wooden casks are, however, favourable to slow oxidation by reason of their porosity, thinness, and the large surface in contact with the air. From this point of view cement vats would be more suitable for wines the aging of which should be retarded, as oxidation is the essential factor of this process. The impermeability of the sides of cement vats to oxygen may be counteracted by periodical injections of air into the wine, which may then be left to oxidise.

Great care must be taken with choice wines, and no modification in the method of making or keeping them should be introduced till repeated tests have shown that the taste will not be modified thereby.

Cement vats should have no cracks, and the sides, joints, iron-work of the cover, and pipe connections (if red copper or bronze are replaced by brass) must not be subject to attack by acids. The absence of cracks results from the composition of the material used, which must be resistant to all surface contraction. Resistance to the acids of the wine may be obtained by direct treatment of the cement with tartaric, sulphuric solutions or silicate, by lining with glass, etc.; the joints also should be treated.

Another danger of cement vats for keeping wine in summer is the formation by drops in temperature of a free surface which may give rise to an excess of air and acetification; as acetic acid is denser than wine it diffuses rapidly. This may be prevented by a slanting bottom, but preventative measures are often useful.

**688 — A Method for the Separation of Protein from Non-Protein Nitrogen in Wheat Flour.** — BLISH, M. J. (Montana Agricultural Experiment Station, Bozeman), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 3, pp. 551-559 + 2 Tables. Baltimore, 1917.

Previous to investigating the biochemical changes in frosted wheat, and their relation to bread-making value, and in order to study the effect of premature freezing on the nitrogen compounds of the wheat kernel, the author found it desirable to develop a satisfactory method for the separation of protein from non-protein nitrogen in wheat flour.

None of the separation methods used for biological products seem to be satisfactory for use with cereals, since these contain alcohol-soluble proteins that do not occur in any other plant or animal tissues. Reagents ordinarily used for precipitating proteins, such as alcohol, acetic acid, trichloroacetic acid, colloidal iron, phosphotungstic acid, tannic acid, etc., are unsatisfactory for removing gliadin from water extracts of flour. The method of RITTHAUSEN (1872), which consisted in alternately adding to the protein in solution dilute copper sulphate and potassium hydroxide until the copper precipitate would no longer dissolve, was found to be the best available by OSBORNE and LEAVENWORTH in their researches on copper-protein compounds; the value of the method can be seen by comparing the

amounts of total nitrogen not precipitated found by using 50 cc. portions of extract :— colloidal iron method (at room temperature), 0.00266 gm.; same method, at boiling temperature, 0.003 gm.; phosphotungstic acid method, 0.0010 gm.; tannic acid method, 0.0012 gm.; copper sulphate method, 0.0008 gm.

The following details of the copper method as used on flour extracts are given below :— 1) *proportion of flour to water in the extract* : the best is 20 parts of distilled water saturated with toluene to 1 part of flour ; 2) *duration of the extraction* : the quantity of nitrogen found in different extracts was the same for extractions lasting 2, 3, 4, 5, 6, and 12 hours respectively ; a minimum extraction period of 2 hours (during which the extract is shaken vigorously every 15 minutes) was adopted ; 3) after filtering the extract, the proteins are precipitated by treating 50 cc. of the filtrate with 15 cc. of N/10 NaOH, followed by 16 cc. of N/10  $\text{CuSO}_4$ . The amount of  $\text{Cu SO}_4$  used should be slightly greater than the equivalent quantity of NaOH. The nitrogen content can be afterwards determined in the filtrate separated from the cupric precipitate by the usual Kjeldahl method and the amino-acids by Van Slyke's microchemical method.

The effectiveness of the test was examined by ascertaining the chemical nature of the nitrogen compounds that remained in solution after the copper proteins precipitation, and it was concluded that the *true proteins were almost completely precipitated* ; only (and other authors confirm this), traces of peptide linkings still remain in solution.

Normal patent flour contains but about 2 mgm. of amino-acid nitrogen for every 100 gm. of flour, and about 3 times as much nitrogen in free acid amide form.

There is probably a considerable amount of *non-protein nitrogen* not precipitated by the copper method which is neither amino-acid nitrogen nor is it in the form of peptide complexes ; its nature is not known.

659 — The Milling Value of the Wheats "Aurore" and "Blé des Alliés". — See No. 650 of this Review

690 — Milling and Breed-Making Tests with Humpback Wheat, in the U. S. A. — See No. 647 of this Review

691 — A Comparison of Linseed Oil and Lumbang Oil as Paint Vehicles. — AGUILAR, R. H., in *The Philippine Journal of Science*, Vol. XII, Sec. A, No. 5, pp. 235-243 : Fig. Manila, September 1917.

"Lumbang bato" (*Aleurites moluccana*) is of very wide geographic distribution extending from India through Malaya to Polynesia. In the Philippines it is common and widely distributed both as a native and as a semicultivated tree. "Lumbang banucalag" (*A. trisperma*) is confined to the Philippine Islands and less common than the preceding species. The seed of *A. moluccana* yields from 60 to 65 per cent oil by extraction with solvents and 55 per cent by hydraulic expression at 500 kg. per square centimetre ; the seed of *A. trisperma* yields about 43 per cent by hydraulic ex-

pression at 310 kg per square centimetre. (The per cents are calculated on the kernel weight).

The lumbang oils are possible substitutes for linseed oil, and they have been much studied, but little has been reported concerning their behavior with different pigments or the quality of the resulting paints. For this reason the author carried out a series of tests on the properties of linseed, lumbang bato and lumbang banucalag oils described in the article under consideration, experiments which gave the following results:—

The drying properties of lumbang bato and lumbang banucalag oil are comparable with those of linseed oil.

Lumbang bato oil is very similar to linseed oil in its properties as a paint vehicle, and like linseed has certain disadvantages for use in red paints.

Lumbang banucalag oil cannot be used as a paint vehicle, especially with red lead; it dries into a paste. This is also true with lumbang bato containing 75 and 90 per cent lumbang banucalag. Lumbang banucalag containing between 50 and 75 per cent lumbang bato will make a good vehicle for red lead.

692 - The Use of *Bacillus felsineus* in Retting Various Textile Plants (1). — CARBONE, D., in the *Bollettino di Studi ed Informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 1-2, pp. 3-9. Palermo, 1917.

The author has found that *Bacillus felsineus* rets the following textile plants:— nettle; ramie (*Boehmeria nivea*); Spanish broom (*Spartium junceum*); *Agave americana*, *A. Zapupe*, *A. sisalana*, *A. Candelabrum*, *A. yuccaeifolia*, *A. Rumphii*; *Furcraea gigantea*, *F. altissima*; *Sansevieria cylindrica*, *S. zeylanica*; *Yucca gloriosa*; *Sphaeralcea angustifolia*, *Grevia oppositifolia*, *G. orientalis*, *Sida Avicennae*; mallow; bark of mulberry branches; Jerusalem artichoke tubers.

693 - The Protein of Cow's Milk. — OSBORNE, T. B. and WAKEMAN, A. J., with the Collaboration of LEAVENWORTH, C. S. and NOLAN, O. L., (Connecticut Agricultural Experiment Station, New Haven), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 1, pp. 7-17, No. 2, pp. 243-251. Baltimore, January and February, 1918.

In all attempts to discover the nature of the water-soluble vitamins in milk it is essential to know the properties and proportion of protein that remains in solution after removing the casein and heat coagulable proteins. This question was very thoroughly studied by the authors. They separated: 1) *lactalbumin*, the composition of which, when ash- and moisture-free, after drying at 110° C., was:— C, 52.51; H, 7.10; N, 15.43; S, 1.92; P, traces; O, 23.04; it was present at the rate of about 2.4 gm. per litre of the original whole milk; 2) *lactoglobulin*, present at the rate of about 0.2 gm. per litre of original whole milk and with the following composition:— C, 51.88; H, 6.96; N, 15.44; S, 0.86; P, 0.24; O, 24.62; 3) an *alcohol soluble protein*,

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(1) See R., October 1917, No. 956. (Ed.)

obtained from the alcoholic washings of the casein precipitate and present in very small amount.

Long and repeated attempts to find if there are any *proteoses* present in the milk, gave no definite results.

SIEGFRIED obtained a product from cows' milk which he called "nucleon", and the authors have concluded that this substance is probably a mixture of uncoagulable protein and some still unidentified organic substance which yields phosphoric acid on hydrolysis.

In the second work, the authors describe their researches on the alcohol-soluble protein, which has the composition:—C, 54.91; H, 7.17; N, 15.71; S, 0.95; P, 0.08; O, 21:18. On analysis 100 gm. of the protein gives:—arginine, 2.92; histidine, 2.28; lysine, 3.98; tyrosine, 2.47. It is an acid compound and gives strong tryptophane, Millon's and buret reactions.

694 — **On the Thermo-Resistance of Non-Sporogenous Bacteria in Milk.** — GORINI, C., in *Reale Istituto lombardo di Scienze e Lettere, Rendiconti*, Vol. XLVIII, Pt. 18 pp. 956-961. Milan, 1915.

A contribution to the study of the thermo-resistance of sporogenous bacteria, which emphasises the principle: — that species or races endowed with exceptional thermo-resistance should be accepted with great caution and it must be ascertained whether such a property is really a character that is *permanent and common* to the generality or at least to the majority of the individuals of a given race of bacteria or whether, on the contrary, it is a case of a protective influence similar to that found by the author in milk. In fact, the author's researches on the survival of non-sporogenous bacteria in sterilised milk, show that it is due, not to the existence of species or races having exceptional thermo-resistance, but rather to the protecting influence of caseous envelopes that form round the organism, apparently due to the life-activity of the germs themselves before and after sterilisation.

695 — **New Contribution to the Commercial Sterilisation of Milk.** — GORINI C., in *Rendiconti del Reale Istituto Lombardo di Scienze e Lettere*, Series II, Vol. LI, Pt. 1-2, pp. 135-140 Milan, 1918.

The sterilisation of milk has already passed through two successive phases of technical progress. The first succeeded in preserving the milk from *rapid and violent changes*, the second from *retarded and slow changes*. By his present studies the author proves that if it be possible to say that this latter problem has been satisfactorily solved by means of improvements in technical methods, there remains yet a third, and perhaps final, obstacle to be overcome. This is the *insidious change* of sterilised milk which can be recognised only after the vessel has been opened and by heating. This change differs from the others in that it is often very difficult to ascertain the bacterial cause, so that mistakes may be made by attributing it to a purely chemical cause.

It is caused by the "acid-rennet producing" bacteria proved by the author to be present in the cow's udder, especially under conditions of in



flammation, even when physiological, because the bacteria survive sterilisation owing to protective coverings which form in the udder or during heating. Moreover the milk may leave the udder containing already enough of this "rennet" enzyme to undergo the insidious change in question by the sole effect of heating even if the organisms are largely dead or inactive. Finally this change differs from the others in that preventative measures cannot be adopted against it in the dairy; they must be applied directly in the *shippon and on the dairy cows*. Methods must be used which will inhibit the abnormal development of the bacterial flora of the udder (careful and complete milking, discarding of the first streams of milk, exclusion of all milk left stagnant in the udder or from inflamed udders even under slight, temporary physiological conditions, etc.) and *dairy cows should be selected according to the bacterial flora of the udder*, as proposed by the author in a previous paper (1). If these principles, as has been the case with the previous ones, are adopted practically in the industry, the remaining difficulties attending the sterilisation and preservation of either sterilised or condensed milk may be eliminated.

696 — **The Composition and Market Qualities of Butter when Corn Silage is Fed with Cottonseed Meal.** — PALMER, L. S. and CROCKETT, D. T., in the *Journal of Dairy Science*, Vol. I, No. 3, pp. 235-245. Baltimore, September, 1917.

One of the most important facts brought out in a recent bulletin (2) regarding the effects which the feeding of cottonseed products exerts upon the composition and properties of butter, was the tendency for certain roughages to counteract in large measure the usual results which follow the use of cottonseed meal. Attention was directed particularly to the counteracting influence of corn silage, but a somewhat limited amount of data were presented by ECKLES and PALMER with regard to the extent to which corn silage counteracts the peculiar market qualities of cottonseed meal butter, just described. As this phase of the question is of considerable practical importance, a more extended study of this point was made by the writers and the results of their experiments are here presented.

Twelve pure-bred cows were selected from the University herd and divided into two groups of six cows each.

The general plan of the experiment, together with the average ration consumed by each group in each period, and the duration of each period is shown in Table I.

(1) GORINI, C., *Rend. R. Ist. Lomb. Sc. Lett.*, 49, 1916.

(2) ECKLES, C. H. and PALMER, L. S.: *Effects of Feeding Cottonseed Products on the Composition and Properties of Butter*. Missouri Agr. Exp. Station Research Bulletin 27, pp. 44, Figures 3, 1916. See R., July, 1917, No. 651. (Ed.)

TABLE I. — *Plan of experiment and average ration consumed in each period,*

Period	Date	Group I.		Group II.	
1	Nov. 5 to Nov. 23, 1916	Silage	lb. 29	Silage	lb. 28
		Hay (1)	9	Hay	9
		Grain (2)	8	Grain	9
2	Nov. 23 to Dec. 15	Silage	29	Silage	18
		Hay	9	Hay	7
		Grain	6	Cottonseed meal	3
		Cottonseed meal	3		
3	Dec. 15, 1916 to Jan. 1, 1917	Silage	29	Hay	18
		Hay	9	Grain	4
		Grain	4	Cottonseed meal	5
		Cottonseed meal	5		
4	Jan. 1 to Jan. 21	Silage	29	Silage	28
		Hay	9	Hay	10
		Grain	7	Grain	9

(1) The hay fed to both groups throughout the entire experiment was a mixture of equal parts alfalfa and timothy.

(2) The grain fed to both groups throughout the entire experiment was a mixture of maize meal two parts, distillers grains one part, wheat bran one part.

### *Results of experiment.*

*Composition of butter.* — An examination of the figures given for the analyses of the different churnings of butter for moisture, fat, curd, ash and salt shows no differences in the composition of the different samples of butter which can be attributed to the changes in the ration.

*Score of butter.* — On examining the data concerning the market quality of the various samples of butter, as shown by the usual method of scoring, it is seen that all the samples of butter were of good quality, the only defect from a commercial point of view being in flavour. Certain slight defects in body were noted in some cases but these were not sufficiently pronounced to lead to a deduction in the score. For example, the butter from three of the churnings of period 2 was characterized as hard and brittle; similarly the body of both churnings of group I in period 3 was stated to be hard, although not objectionably so, while no note was made with regard to the body of either churning from group II in this period. With regard to the oily flavour which frequently characterizes cottonseed meal butter, this was noticed only in the case of the two churnings from group I in period 3.

The results of these experiments on the market qualities of the butter may be, therefore, summarized as follows :

1) Cottonseed meal, when fed in quantities of 3 to 5 pounds imparted a slight oily flavour and harder body to the butter, but these defects were not sufficiently pronounced to detract materially from the market value of the butter.

2) The effects of the cottonseed meal feeding were fully as pronounced when fed with maize silage, as when a mixture of alfalfa and timothy hay constituted the only roughage.

*Keeping quality of butter.* — Previous experiments have been uniform in showing that butter made when cottonseed meal forms a part of the ration retains its original flavour appreciably longer than when no cottonseed meal is fed. The general result of the study was to confirm the former results showing a superior keeping quality of butter made on a cottonseed meal ration over that made when the ration contains no cottonseed meal. The feeding of cottonseed meal materially retarded the rate of deterioration of butter kept at 8° to 12° C. This effect was secured when the cottonseed meal was fed with maize silage as well as when it was fed with hay.

*Chemical and physical constants of butter fat.* — The results of the analyses of the butter fat are shown in Table II.

TABLE II. *Chemical and physical constants of butter fat on different rations.*

Period	Group	Saponification Value	Reichert-Meissl Number	Iodine-Value Hubl	Melting Point °C	Standing-up Temperature °C
1	I	234.9	31.66	28.10	32.90	34
2	I	232.9	30.95	29.01	34.18	34-35
3	I	233.4	31.03	28.88	34.10	35-36
4	I	232.2	29.63	30.22	33.03	34
1	II	236.8	33.27	29.70	32.38	33
2	II	229.2	29.63	34.69	34.35	34-35
3	II	227.4	30.01	34.42	33.98	35-36
4	II	232.5	30.73	32.11	32.45	33

Abnormally high saponification and Reichert-Meissl values and an abnormally low iodine value are the striking features of the fat constants during liberal silage feeding. The melting point of the fat was increased slightly by the cottonseed meal in periods 2 and 3, and this effect was also noticed in the increased standing-up temperature of the butter.

Very different results characterized the feeding of the cottonseed meal in periods 2 and 3 in the case of group II, in which the roughage was also changed to one of hay only. A marked depression of the saponification and Reichert-Meissl value and increase in the iodine value and melting point characterized the fat constants in these periods in comparison with the constants of the fat in the basal periods. The standing-up temperature of the butter was also increased. Such effects are characteristic of cottonseed meal feeding when dry roughage is fed.

One or two other features of the data in Table 2 may be mentioned. It is noticed that the fat constants of group II were not abnormal in any of the periods, even in period 3 when 5 pounds of cottonseed meal were fed with a dry roughage of hay only. These results are probably due, in part at least, to the fact that the fat constants were already abnormal in the opposite direction from those which usually characterize cottonseed meal feeding, when the ration was changed to include the cottonseed meal. Another feature of the data was that no greater effects were secured when 5 pounds of meal were fed to group II than when 3 pounds were fed.

Very great difficulty is also experienced in attempting to explain why the addition of cottonseed meal to a ration containing of a liberal portion

of silage fails to affect any of the fat constants except the melting point of the butter fat. The results of the present experiment on the chemical and physical constants of butter fat may be summarized as follows : —

The liberal use of maize silage in a ration counteracted all the effects which 5 pounds of cottonseed meal usually exert upon the chemical constants of butter fat in that the addition of the cottonseed meal to a ration containing a liberal amount of maize silage was without effect upon the fat constants.

697 — **The Determination of Fat in Certain Milk Products.** — FRANCIS, C. K. AND MORGAN, D. G., in the *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station Bulletin No. 114*, pp. 1-4. Stillwater, Oklahoma, April, 1917.

A method for determining fat, including treatment of the samples, in such dairy products as ice cream (requiring 14 % fat content by law), evaporated milk, malted milk, dried skim-milk and similar milk products, is described. The procedure is similar to that followed when using the Babcock test, but in place of sulphuric acid, mixtures of glacial acetic, sulphuric and nitric acids are prescribed. The fat is separated and read in a Babcock bottle.

698 — **Wool Studies. — Washing Sheep Before Shearing; Time of Shearing.** — HAMMOND, J. W., in the *Ohio Agricultural Experiment Station Bulletin No. 294*, pp. 309-322. Wooster, Ohio, April, 1917.

This experiment was undertaken for the purpose of securing data on the following points :— 1) The influence of washing sheep on the yield of grease and of scoured wool and on the rate of gain made by the sheep ; and 2) the influence of the time of shearing on the yields of grease and scoured wool and on the rate of gain made by the sheep.

*Plan of the Experiment.* — One hundred lambs, practically purebred Merinos, born in 1910, were divided into four lots as nearly alike as possible with respect to sex, weight and conformation. The experiment extended over a little more than 2 years, so that during its progress three clips of wool were removed.

The treatment of the lots with respect to washing and time of shearing was as follows :—

*Lot 1:* Washed; shorn about April 12.

*Lot 2:* Unwashed; shorn about April 12.

*Lot 3:* Washed; shorn about June 1.

*Lot 4:* Unwashed; shorn about June 1.

*Washing and shearing.* The sheep were washed by hand in a stream 7 to 10 days before shearing with power-driven clippers.

*Scouring the wool.* — The scouring was done by the emulsion process, similar to that used commercially. The wool was put through three scouring liquors containing potash, soap and potassium carbonate of gradually diminishing strength, and finally through a rinse of clear warm water. The wool was dried to a constant weight at a temperature of 150° F. both before and after scouring to overcome any differences in moisture content.

From the results presented it appears that the washed sheep produced

1.49 pounds less grease wool per head when shorn April 12, and 2.64 pounds less per head when shorn June 1, than did unwashed sheep shorn on the same dates. Washing the sheep had practically no effect on the amount of scoured wool produced or on the rate of gain made by the sheep.

Wool shorn June 1, both washed and unwashed shrank more in scouring than did wool shorn April 12.

The results of this experiment also indicate that, in many cases at least, not sufficient premium is paid for washed wool to cover the cost of washing and for the loss in weight of the wool.

Since washing sheep does not improve the quality of the wool fibre and does not diminish the cost of scouring; the practice is not beneficial to the manufacturer.

Washed sheep shorn April 12 produced more grease wool than did washed sheep shorn June 1, while unwashed sheep shorn April 12 produced less grease wool than did unwashed sheep shorn June 1. This indicates that between these two dates there was an increase in weight of fleece due to the accumulation of a greater proportion of yolk or other foreign matter in the wool. Sheep shorn April 12, both washed and unwashed produced slightly more scoured wool than did sheep shorn June 1. Sheep shorn April 12 made slightly greater gains than did sheep shorn June 1.

**699 — The Indian Hide and Leather Trade.** — LEDGARD HENRY (Late President, Upper India Chamber of Commerce), in the *Journal of the Royal Society of Arts*, Vol. LXVI, No. 3407, pp. 274-282, London, March 8, 1918.

The quality of the hides from Indian cattle is not so good as that from Argentine cattle, for, while Argentine cattle do no work, the Indian oxen are used for agricultural purposes. Moreover, on the Argentine, branding is used as a means of identification only, in India it is commonly adopted as a cure for various ailments. Fortunately the cows and female buffaloes are rarely worked, so that their hides are generally in good conditions and are even superior to those of Argentine cows. In England the hide of a slaughtered animal is worth in normal times from  $\frac{1}{12}$  to  $\frac{1}{10}$  of its total value, in India, it is worth  $\frac{1}{3}$  of the value of the animal. For this reason, when there is a large demand for hides, the cattle are often slaughtered for the value of their hides alone. The Indian hide trade is of great importance, coming fifth in the value of exports, even preceding tea.

It has been shown that as a result of the increased consumption of meat throughout the world since the war, a great shortage of hides and leather is to be anticipated in the future. It is estimated that the world's meat-producing animals have decreased as follows:— cattle, 28 080 000 head; sheep, 54 500 000 head; hogs, 32 425 000 head; or a total of 115 005 000 head. Before the war the world's supply of hides was barely sufficient, and prices were steadily rising. The above figures show, that after the war there will be a serious shortage of this product.

In those parts of India where the climate is dry the hides are simply cleaned and dried in the sun or shade. Before baling they are dipped in arsenic solution and again dried. This is considered the best method. In the

damp climate of Bengal and during the rainy season in other provinces, drying is difficult, and the hides are usually salted. This system does not always give satisfactory results. Arsenicated hides are sold by weight, salted hides by the piece after selection and classification.

The hides are divided into various classes as follows :

1) " Commissariats " ; these are the best quality hides. The name was derived from the C branded on the neck of cattle bought by the Indian Government to be fed well for about three months and then slaughtered to supply the army with meat. Although this practice has long ceased the term remains and indicates the highest grade of hide ;

2) " Slaughtered ", a term applied to the hides of animals which have been slaughtered to distinguish them from those which have died naturally ; they are the second grade ;

3) " Deads ", the third grade ;

4) " Rejections ", the lowest grade.

These terms are still in use on the chief markets of India.

There are several varieties of goatskins in India. The best, known as " Patnas ", are from the province of Behar, and are excellent for making glacé kid. Further east, in Dinapore, Bengal, and Eastern Bengal, the skins are larger and heavier in grain and texture but still suitable for glacé kid. In the United Provinces and Rajputana the skins are also larger and coarser than " Patnas ", and only the lighter ones can be used for glacé kid ; the heavier ones are suitable for " Moroccos ", but, unfortunately, often have many holes. In the Punjab the goatskins, known as " Amritsars ", are large, strong and heavy, well adapted to upholstery. In the south Hyderabad and Deccani skins are of fair quality and are bought by the Madras tanners.

Before the war 3 million cow, ox and calf hides were tanned in India and exported annually. At the present time this figure is doubled. The tanning industry is of great importance in India and its further expansion is to be anticipated.

The tanning process resembles that which was used in England before the introduction of labour-saving devices. Labour is plentiful in India, and the native tanners still adopt the primitive methods. In Madras and Bombay the tanning material used is the bark of *Cassia auriculata*, which grows in the jungle ; it is a shrub which grows to a height of from 6 to 8 ft., the shoots of which are cut every three or four years. It is an excellent tanning material, making the skins soft and pliable. The hides are often only partially tanned, so that the European currier has to complete the process, often improving the material thereby. At Cawnpore in the United Provinces there are some large tanneries equipped with modern machinery. The first of these factories was erected 40 years ago by the Indian Government and, in normal times, supplied the leather required by the different branches of the army. The chief tanning materials used at Cawnpore are *Acacia arabica* and *Terminalia Chebula*. The former, which is found over a wide area, is not ripe for cutting till ten or twelve years old. Up to the present these plants have not been systematically cultivated. In view of the increasing

demand for tanning material the Indian Forest Department should attempt to produce an ample supply of tanning bark, which will be very necessary in the future, but should not be left to private enterprise.

In addition to the commercial centres mentioned there are still in the villages primitive tanneries for supplying local requirements. Chrome tanning, though adopted only to a limited extent, could be greatly developed.

With reference to the export of goatskins, before the war India exported annually 20 million raw skins and 7 500 000 tanned skins. The United Kingdom purchased most of the tanned skins, about half of which were reexported to the continent, and about a third of the remainder to America.

Of the raw skins, 75 % were exported to America, 10 % to England, 7 % to France, 5 % to Holland and Belgium, and an insignificant quantity to Germany. Since the war America takes 88.5 % and English imports have dropped to 8 %.

Previous to the war 2 200 000 raw sheepskins and about 9 000 000 tanned ones were exported. America took 87 % of the raw skins in 1913-1914, and 96.5 % in 1915-1916. Of the tanned sheepskins, the United Kingdom imported 58.9 % in 1913-1914 and 64 % in 1915-1916, the United States 20.9 % in 1913-1914 and 19.8 % in 1915-1916; Japan 15 % in 1913-1914 and 11.8 % in 1915-1916.

About 160 000 tanned buffalo hides were exported to England. Of the 2 000 000 raw hides one half went to Germany, one third to the United States, and the remainder was distributed between the United Kingdom, Holland and Italy. The export of ox and cow hides reached about 11 million pieces, 3 million of which were tanned; the tanned hides went to England and the raw hides to the Continent.

Figures for the shipments of raw ox and cow hides to Europe and America are given in a table covering the period from 1872 to 1915.

700 - **The Cold-Storage Plant of Lyndiane, Senegal.** — MOUSSU, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 12, pp. 394-400. Paris, March 27, 1917.

The author reviews a study by M. J. DERRÉ who is in charge of the sanitary inspection of the plant of Lyndiane in West Africa. The installation of the Lyndiane plant in Senegal has made possible the exploitation of one of the principal natural resources, hitherto unused but sure to prove of increasing importance as a result of the abundant livestock and immense pasture lands.

To fulfill the requirements of the home country it has been necessary to make use of herds not only from Senegal but also from the whole of French West Africa. The oxen slaughtered at Lyndiane in 1916 came from Senegal, Niger, Mauritania and Guinea; these districts are in order of importance.

The livestock of different breeds from these districts, which form an immense stretch of land, is not all equally suitable for slaughtering. Owing

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to its extensive breeding and the position of its plant near the centres of production Senegal holds the first place for quality of meat. The oxen of the Zebu breed ("peuhle" variety) of the Senegalese provinces of Cayar, Baol and Sine Saloum, give a much higher yield than all the other cattle slaughtered, no matter where they come from.

Upper Senegal-Niger is the reservoir of Senegal for cattle; 4 238 oxen from the Soudan, Macina, or the north of the Niger bend were slaughtered at Lyndiane in the year 1916.

Unfortunately the remoteness of the breeding centres necessitates long journeys which cause the animals to lose flesh and thus decrease the yield, for the average weight of the stock from this district is only 596 lb. The average weight of the animals from Mauritania is 583 lb., with a yield of barely 45 %. French Guinea, a remarkable breeding centre, supplies cattle with an average weight of 506 lb. with a 47 % yield.

During 1916 the plant bought 27 350 oxen with an average weight of 537 lb. giving, when killed, a 46 % yield. This meat is exported to France in frozen quarters or as preserved, seasoned beef.

The Lyndiane installation can slaughter 200 oxen in 24 hours; this figure was reached in December and January, but has dropped to 110 on account of irregular delivery. The plant, originally built for freezing meat only, has five freezing rooms of a capacity of 200 metric tons, and five storage rooms, of a capacity of 300 metric tons. From May 1 to December 31, 1916, 13 198 quarters weighing 777 metric tons were delivered, and at the present time the storage rooms are full. The offal (heart, liver, brain, tongue, kidney) are also frozen, packed in 100 lb. cases and sent to France. The suet, intestines and bones are treated in a separate establishment. During the year 1916, 130 154 lb. of commercial suet and 5 665 lb. of edible fat were sold. The hides are treated with special care and, owing to the proximity of salt water, their preservation is assured until they are utilised in France.

It is estimated that the Lyndiane plant could deal with 30 000 cattle annually, and perhaps more. Besides the cattle, of which there are more than 5 million, there are other resources which could be profitably exploited. Experiments in pig-breeding are now being carried out at Siné-Saloum, and are likely to give good results. Already a rapid production of as much as 5 000 head a year seems likely. The variety used is related to the Spanish breed. It is very prolific and breeding will probably increase with yet greater rapidity since the cultivation of manioc has spread throughout the villages. There are very few sheep in Senegal and they are kept by the natives for their own food. Those in Mauritania and Macina are too far away from Lyndiane to be delivered in a sufficiently good condition.

Breeding, if well carried out, cannot fail to increase and improve rapidly, bringing to the colony an un hoped for income and to the home country a great simplification of the serious economic problem of its meat supply.



701 - **Enzyme Activity at the Temperatures Maintained in Cold-Stores.** — BLANCHET, A., in *Le Froid*, Year V, Vol. V, No. 1, pp. 6-9. Paris, January-March, 1917.

The investigations carried out by the author in 1913-1914 aimed at estimating the activity of certain enzymes at temperatures slightly below 0°C., generally used in the cold-storage establishments for storing products in which the action of such enzymes or others of the same group may occur.

He studied a lipase to ascertain its action at temperatures corresponding to those used in preserving butter and other fats. The enzyme examined was one existing in the cytoplasm of castor-oil seeds, which is the one best known at the present time; it was the object of a remarkable study by M. NICLOUX. The castor oil seeds were crushed in a mortar and then mixed with castor oil. The mixture was then acidified with acetic acid. The oil, seeds, and acetic acid were previously cooled during 24 hours in cold rooms.

The acidity was estimated with normal soda after the alcohol reaction had ceased. The activity of the lipase at laboratory temperature (17°C.) was also tested.

The results show definitely that, even at - 5° C, the lipase is sufficiently active to cause a fairly rapid saponification of the fats. There is, therefore, no reason why a certain number of the changes fats undergo while in cold-storage should not be attributed to the action of enzymes of this same group.

The fact that the good keeping of butter is in inverse ratio to the acidity of the cream at the time of churning confirms this hypothesis, for the action of lipases is generally favoured by a certain acidity. This was confirmed by the enzyme studied by the author as well as by the sero-lipase.

702 - **Preserving Fish without Ice.** — Abstract from the *Bulletin mensuel de la Chambre de Commerce française de New York*, in *Le Froid*, Year V, Vol. V, No. 4, pp. 157-159. Paris, October-December, 1917.

In British Colombia and in England a new method has been adopted for keeping fresh fish. As ice is no longer necessary the fish can be sold cheaper because the expense incurred through the ice is done away with. The fish keeps its flavour perfectly, and the method may be applied to either fresh or smoked fish, and even to meat.

The whole procedure lasts only three hours. The fish is first placed in a cooling tank containing water at a low temperature. After half an hour the latent heat of the fish has completely disappeared. The fish is then placed in a tank containing sea water or fresh water to which salt has been added. To prevent the water from freezing it is stirred by a pump which sends it into a pipe in which it passes through a filter filled with willow charcoal which kills all bacteria and then passes out again. The extremely cold temperature of the salt solution closes the pores of the skin of the fish, prevents saturation and acts on the exterior as a disinfectant. At the end of three hours the fish is taken out and has the appearance of fresh fish. There is no danger of its going bad for 10 days and it may be kept for months in a cold room. A plant has been set up in Portugal for preserving fresh fish by this method. According to the English engineers who installed the plant the fish keeps fresh and in excellent condition

for about 15 days, even at a variable temperature. The flavour is that of fresh fish. It does not go soft like fish kept in ice, and may be smoked after having been treated. The method is highly recommended by the inspector of the Dominion fisheries.

M. A. CLIGNY, Director of the Marine Station of Boulogne-sur-Mer, France, believes the method to be of the greatest value. It includes two independent parts, the first of which appears the more original, and may be called pre-refrigeration. It is always advisable to wash fish before any freezing procedure, and it would be excellent to wash it in very cold water which would bring it to a temperature of about 0°C. This is an important improvement on the expensive and defective method of covering it with ice or laying it out in cold and relatively large stores for a period of time which must of necessity be very long. Pre-refrigeration by thorough washing in very cold water could be carried out advantageously in fishing boats. It might be of great importance in the mixed installations, proposed by M. CLIGNY for fishing boats (1) in which the use of ice plays its essential part.

The second part of the method consists in freezing the fish previously cooled to 0°C. This second stage may be attained by the use of ice, dry cold or, as the author proposes, soaking in cold brine.

703 - **The Supply of Canned Salmon in the United States** — BRAND, C. J. in U. S. Department of Agriculture, Office of the Secretary, Circular No. 98, pp. 1-16, Washington, D. C., February 28, 1918.

Commercial stocks of canned salmon in the United States on August 31, 1917, amounted to approximately 310 000 000 pounds. Four-ninths of these stocks were located in the State of Washington.

Nearly three-fifths of the total stocks reported were held by canners of sea food. The stocks of these concerns were practically all reported from the states of Washington, Oregon and California, the canners in the first named state reporting more than three-fourths of these holdings.

One-eighth of the total commercial stocks was held in storage warehouses. As in the case of stocks of canners, those in storage were again chiefly located in the state of Washington, this state reporting two-thirds of these stocks. The wholesale stocks, which constituted more than one-sixth of the total commercial stocks, were fairly well distributed in proportion to population. The stocks of retail dealers which constituted about one-eighth of the total, appear to bear a less close relation to population, the stocks of some of the Southern States being relatively small.

The results of the survey indicate further that the stocks of canned salmon in hand on August 31, 1917, were 18.2 per cent larger than those reported for August 31, 1916. The stocks of canners of sea food showed a marked increase, this increase being only partially offset by decreases in the stocks held in storage warehouses and by wholesalers. The stocks of retailers were practically equal in amount on the two dates.

This Bulletin gives detailed information concerning the extent and the distribution of the supply of canned salmon on the date of the survey.

(1) See *Comptes rendus du 2ème Congrès français du Froid*, Toulouse, 1912, Vol. I, pp. 546-558 (Author).

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

GENERAL

704 - **Myxomycetes and Fungi of Ceylon.** — FETCH, T., in *Department of Agriculture, Ceylon. Annals of the Royal Botanic Gardens, Peradeniya*, Vol. VI, Pt. 3, pp. 193-256. Colombo-London, June, 1917.

The list includes 6 myxomycetes and 235 fungi collected and identified in the island during the last few years. *Oidium* spp. has also been reported on 27 different plant hosts. Notes have previously been published on some of the species enumerated.

Among the fungi are described as new to science, 46 basidiomycetes (20 hymenomycetes, 2 gasteromycetes, 24 uredinaceae), 18 ascomycetes (all belonging to the pyrenomycetes), 52 deuteromycetes (14 representatives of the order *Sphaeropsidales*, 7 of the order *Melanconiales*, 31 of the order *Hyphales*.

There are very numerous species of fungi either new or already noted, which were found on cultivated plants or on those useful to man in some way or other.

705 - **New Japanese Fungi** (1). — TANAKA TYOZABURO, in *Mycologia*, Vol. X, No. 2, pp. 86-92, Lancaster, Pa., March, 1918.

In this, the fourth paper on the subject, are given in English the descriptions originally published by various authors in Japanese, of the following species new to science.

1) *Botrytis Liliorum* Y. Fujikuro, n. sp. (published in May, 1914); found on *Lilium longiflorum* at the Experiment Farm of Formosa (Taikazeiho, Taihokuchō) among plants from Lûchû Island. The fungus attacks especially the leaves, on which form small spots about 1 mm. in diameter which soon cover the whole leaf, causing the total decay of the host plant; the fructifications of the fungus appear on the decayed part of the plants as a fine, powdery fur.

2) *Phyllosticta (Phoma) kuwacola* K. Hara, n. sp. (May 1917) on living leaves, shoots and twigs of *Morus alba*, at Mino (Gifu-ken) and neighbouring

(1) See R., Jan., 1918, No. 182. (Ed.)

prefectures. The parasite causes the formation of leaf spots which gradually dry up; the leaves tear in dry weather and rot in wet weather. If the spots appear on the edges of the leaves semi-circular holes are often formed. Adjacent spots coalesce, forming irregular spots which often cover a large area of the leaf and cause the whole blade to decay. Young twigs are also attacked, turn brownish, and die, showing on the surface minute black pustules. Hard twigs when attacked have reddish spots which turn blackish after and sink considerably below the surface; they are rough and cracked. The disease causes the death of the upper part of the twig. The new Japanese name of the disease is "Kuwa no Rinmonbyô" (circle blotch of mulberry). Considerable damage is done every year.

3) *Septobasidium Acaciae* Sawada, n. sp. (November, 1911) on trunks and twigs of *Acacia Richii*. The typical locality is Taikoku-chô Shakuko (Formosa). The fungus has been observed on the euphorbia *Glochidion obovatum* on the Experimental Farm of the Agricultural Station of Formosa and on *Citrus* sp. at Taihoku-chô Kiirun; later (February, 1915), SAWADA reported this fungus in Formosa on *Prunus Persica*, *P. salicina*, *Thea sinensis*, *Salix glandulosa* var. *Warburgii* and *Melia Azedarach*. The attack of the fungus is closely related to that of certain scale insects and in many cases the dead insects are found surrounded by mycelial strands. The fungus sometimes kills *Acacia* trees; to control it a 30-50 % wood-ash solution is recommended.

4) *Cercospora Pini-densiflorae* Hori and Nambu, n. sp. (May, 1917) on the leaves of young *Pinus densiflora*, in the nursery of Makago, in the south of Kyushu Island. A great many young plants, mostly two years old, were fatally attacked. According to the reports the disease seems to be limited to the above mentioned locality, but it seems likely to prove serious unless controlled by treating seedlings with Bordeaux mixture.

5) *Helicobasidium Tanakae* Miyabe. This species, also given as *Stypinella Tanakae* Miyabe and *Septobasidium* sp. is very common in Japan on the trunks and branches of *Morus*, *Salix*, *Vitis*, *Juglans*, *Zanthoxylum*, *Prunus Mume*, *P. donarium* (= *P. paniculata*), *P. salicina*, *P. Armeniaca* var. *Ansu*, *Pyrus Malus*, *P. sinensis*, *Ribes Grossularia*, *Kerria japonica*, *Thea sinensis*, *Paulownia tomentosa*, *Firmiana platanifolia* (= *Sterculia platanifolia*) and *Pittosporum undulatum*; most Japanese authors who have described this species have confused it with *Septobasidium pedicellatum* (Schw.) but the real *Sept. pedicellatum* was first discovered by SAWADA in Formosa, where *Helic. Tanakae* does not appear to exist; *Sept. pedicellatum* appears to attack the mulberry only and also to differ in certain morphological characteristics.

6) *Nothopateella moricola* I. Miyake n. sp. (Dec., 1916) on twigs of *Morus alba*; typical locality, Iwate-Ken, Morioka-shi.

7) *Ustilina Mori* R. Hara n. sp. (May, 1917) on trunks of *Morus alba*; typical locality, Mino (Gifu-Ken prefecture), Kawakami-mura.

As regards *Valsa Paulowniae* Miyabe and Hemmi, the author points out that, besides the Japanese description recently translated by him into

English (1), two other descriptions of the fungus have been published by Dr. HEMMI, one of the discoverers of the species; all three descriptions are marked n. sp. The first article, published with the original description of the fungus (in English) appeared on July 31, 1916; it contains a full account in Japanese of the disease caused by the fungus, and compares it with other similar diseases. The third and last of these articles was published in English on September 20, 1916; it also describes *V. Paulowniae* in English. Dr. HEMMI notes that the fungus was first collected in Aomori-ken (N. Honshû), in August, 1913, by T. NAKAMURA and reported as a serious disease of the "kiri" tree. All three articles are important as they throw light on a very destructive disease of *Paulownia* in Japan, a disease analogous to chestnut blight in America, both in its swift destructive action and in the loss it causes of timber much valued for cabinet-making.

706 - **Fungi of the Philippine Islands** (2). — SACCARDO, P. A., in the *Atti dell' Accademia Veneto-Trentino-Istrianza*, Vol. X, pp. 57-94, Fig. Padua, 1917.

In the present fourth contribution to the mycological flora of the Philippines, the author lists 149 fungi collected and communicated as previously by Prof. C. F. BAKER.

Almost all the species enumerated come from Lucon Island and principally from the region of Los Bassos and Mount Maquiling (1098 metres high).

Four genera and 109 species, the latter belonging chiefly to the Deuteromycetes, are described as new to science.

707 - **The Resistance of Plants to Diseases and Pests, in Relation to the Acidity of the Sap.** — See No. 630 of this *Review*.

RESISTANT  
PLANTS

708 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 682 of this *Review*.

MEANS  
OF PREVENTION  
AND CONTROL

709 - **Principal Diseases of Vegetables in Ontario, Canada.** — HOWITT, J. E. and JONES, D. H., in *Ontario Department of Agriculture, Ontario Agricultural College Bulletin* 258, pp. 48 + Figs. Toronto, Ont., 1918.

DISEASES  
OF VARIOUS  
CROPS

This bulletin aims at supplying growers with the information necessary for the identification of the most common bacterial and fungoid diseases. The most efficient remedies are also given.

A list is given of the diseases attacking asparagus, dwarf beans, beet, cabbages, cauliflower, carrot, celery, maize, cucumber, lettuce, melon, onion, pea, potato, pumpkin, tomato and turnip.

710 - **Lettuce Drop, Caused by *Sclerotium Liberiana*, in Florida U. S. A.** — See this *Review*, May 1918, No. 583.

(1) See *R. Oct.*, 1917, No. 965 (*Ed.*)

(2) See *B.*, Sept. 1915, No. 976 and *R.*, May 1918, No. 587. (*Ed.*)

- 711 — **Observations on the Parasitism of the Ascomycete, *Ustilina vulgaris*, in France.** — PATOUILLARD, in the *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Pt. 2, p. 100 Paris, 1917

This fungus, well known as a saprophyte, appears to have caused the death of two lime trees in Ain, by attacking them at the base at the ground-level. The two trunks were covered for a height of 8 or 12 in. with a continuous layer of fungus, save for a width of 4 in. which remained unattacked.

The wood was completely invaded by the mycelium and had become soft up to the centre of the trees, so that a simple gust of wind sufficed to blow them down. This *Ustilina* is very common on old stumps near by, both in its aecidial and conidial forms but always as a saprophyte. In the present case it is clearly a parasite.

### WEEDS AND PARASITIC FLOWERING PLANTS.

- 712 — **The Worst Weeds in Cereal Crops, in Indiana, U. S. A.** — See No. 639 of this Review.

- 713 — **The Destruction of Weeds by Sodium Bisulphate.** — *Feuille d'informations du Ministère de l'Agriculture*, Year XXIII, No. 8, p. 8 Paris, 1918.

Experiments have been undertaken in France with the object of destroying weeds among cereal crops by means of sodium bisulphate.

It was found that suitable proportions to use were: — about 80 gall. per acre of a 45 % sodium bisulphate solution (99 lb. of bisulphate dissolved in 22 gall. of water), or 360 lb. of bisulphate per acre to be treated.

Sodium bisulphate is much easier to use and requires fewer precautions than sulphuric acid, which is so often used for the same purpose.

The bisulphate is produced in large quantities by powder-works which supply farmers with 5 or 10 ton truck loads at 1½ d. per 220 lb. free on rail, put up in wooden tubs provided by the buyer.

The following powder-works can supply the bisulphate: Angoulême, Bergerac, Toulouse, Saint-Chamas, Saint-Fons, Moulin-Blanc, Vonges.

### INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

#### GENERAL

- 714 — **Hymenoptera Parasitic on Injurious Insects, in Southern Brazil.** — BRÊTHES, J., in the *Anales de la Sociedad Rural Argentina*, Year LIII, Vol. LII, No. I, pp. 7-11 + 2 Fig. Buenos Ayres, 1916.

Dr. A. Ronna has sent from Pelotas (Rio Grande do Sul) to the Biological Institute of the "Sociedad Rural Argentina" 6 hymenoptera parasitic on insects and representing 1 genus and 5 species new to science, which are described by the author. These hymenoptera are given below.

- 1) *Lytopilus melanocephalus* n. sp., parasitic on an undetermined lepidopterous larva injurious to lucerne (possibly *Colias lesbia*).
- 2) *Aphidius brasiliensis* n. sp., parasitic on aphids.
- 3) *Heptasmicra brasiliensis* n. sp., possibly parasitic on *Oiceticus*.
- 4) *Heteroscapus ronmai* n. gen. and n. sp., parasitic on the larva of an unidentified lepidopteron.
- 5) *Perissocentrus argentinac* Crawford. var. *caridei* Brêthes (1).
- 6) *Tetrastichus isis* n. sp., possibly parasitic on *Oiceticus*.

(1) See R., October 1917, No. 981. (Ed.)

715 — *Dictyothrips aegyptiacus*, a Thysanopteron Injurious to the "Black Morocco" Variety of Vine, in Cyrenaica. — ZANON, V., in *L'Agricoltura coloniale*, Year XI, 2nd Half-Year, No. 6, pp. 394-397 + 2 Plates. Florence, 1917.

At Fuehat and in other vineyards in the neighbourhood of Bengasi, the author found, during 1916 and 1917, that *Dictyothrips aegyptiacum* (Marchal) Del Guercio was present 'almost exclusively on the "Black Morocco" variety of vine ("ribier" in French, "uva damascena" in Italian) somewhat suffering from drought and grown on a trellis and kept low.

This tiny thysanopteron not only soils the foliage with its excreta which appear as scattered groups of small black points, but also pierces the leaf blade, causing the formation of discoloured areas of varying size, and eventually the drying-up of the leaves themselves.

The morphological description of the various stages of development of the insect is followed by notes on its biology.

716 — *Lonchaea aristella*, a Dipteron Injurious to the Fig Tree and the Wild Fig Tree in Italy 1. — I. SAVASTANO, L., in *Annali della R. Stazione di Agricoltura e Frutticoltura, Acireale*, Vol. IV, pp. 113-146 + 2 Pl. Acireale, 1917. — II. SILVESTRI, F., in *Bollettino del Laboratorio di Zoologia generale e applicata della R. Scuola superiore d'Agricoltura in Portici*, Vol. XII, pp. 123-146 + 19 Figs. Portici, 1917.

SAVASTANO, who was the first (in 1915) to report the presence of *Lonchaea aristella* Beck ("mosca nera del fico", black fig fly) in Italy, has continued his studies on this dipteron, injurious to the fig tree in the Sorrento peninsula, and especially in Vico Equense.

SILVESTRI made observations in the neighbourhood of Portici, near Naples, and in Cilento, and examined specimens of the insect from various Italian localities and other districts bordering on the Mediterranean (province of Porto Maurizio, Perugia, Caserta, Benevento, Bari, Lecce, Cosenza, Catania, Trapani, Palermo, Sassari, and Portugal, Spain, Corfu, Tripoli, Algeria). He recognised that the fly is a parasite which does much damage to the wild and the ordinary fig trees.

Both authors give much information on the biology and habits of the insect of which SILVESTRI gives a detailed morphological description.

The only varieties of fig tree attacked are those the fruit of which have large scales arranged almost horizontally, not short and converging towards the interior of the eye. Among the cultivated varieties those attacked are, in the province of Naples, "troiano" and "natalino"; in Cilento, "pas-carolo" and "fico a tre produzioni"; in Sicily, "biancolillo" and other white and black varieties.

Of the wild fig-trees, which, according to SILVESTRI is the fly's favourite plant host, the varieties with an elongated, oval receptacle, well-developed cavity and horizontal scales, are the best suited to the development of the insect.

The enemies of the insect mentioned by SAVASTANO include ants, the coleopteron *Sinoxylon sexdentatum* Oliv., the becacico and the finch. From pupae of *Lonchaea*, collected at Portici and Resina, SILVESTRI ob-

(1) See B. July, 1915, No. 777. (Ed.)

tained specimens of a chalcid hymenopteron, *Pachyneuron vindemmiae* (Rond.), which however, is of little or no importance in controlling the insect.

As regards artificial means of control, besides collecting and destroying the ripe and unripe receptacles which have fallen, the cultivation of the varieties most attacked should be given up, or at least limited. The wild-fig, unless absolutely necessary to ripen the receptacles of varieties of real economic importance, should not be cultivated. Where caprification is necessary only those varieties of wild fig should be used the receptacle of which has short scales converging towards the interior of the eye.

According to SAVASTANO, too great cultural care should be avoided, especially excessive fertilising with farm-yard manure, because this causes a greater separation of the scales, thus facilitating attack by the insect.

The practice of "touching", adopted in the province of Naples, by which a drop of olive oil is placed in the eye in August to hasten ripening, is an indirect means of defence against the fly; the eye contracts, the scales do not open, and the oil penetrates the interstices, so that the insect cannot deposit its eggs in the fruit.

717 - *Corythuca spinulosa* Gibson, a New Lace-bug on Wild Cherry in New Jersey.

— DICKERSON E. L. and WEISS, H. B., in *Entomological News*, Vol. XXIX, No. 4, pp. 121-125 + 1 Plate. Philadelphia, April, 1918.

This paper gives a morphological and biological description of *Corythuca spinulosa* Gibson, first observed towards the end of the summer of 1916 feeding on leaves of wild cherry (*Prunus serotina*) at Jamesburg, New Jersey. So far this species has only been found in that locality.

718 - *Insects Injurious to Forest Trees in Sweden in 1916.* — TRAGARDH, IVAR, in *Skogen*, Year V, Pt. 1, pp. 10-20 + 5 Figs.; Pt. 2, pp. 45-62 + 8 Figs. Stockholm, 1918.

The paper contains a list of the insects injurious to forest trees reported in Sweden in 1916, together with notes on their distribution throughout the kingdom, especially from the point of view of local climatic conditions.

*Ips typographus* L. ("Granbark borren") and *Pityogenes chalcographus* L. ("Sextandade Barkborren"). The province of Härnösand was the chief centre of attack; here the insects were reported from nearly all the forests (70 %). Then came, Mellersta Norrland, Gävle, Dala, and Östra, with 50 %. No damage, however, was reported from Övre Norrbotten or the province of Skellefteå, but in Nedre Norrbotten, Umeå, and the province of Bergslag, 25 to 28.5 % of the forests were attacked. In the southern districts of Västra, Småland and Södra, the figures vary between 10 and 22 %.

The temperature has a great influence on the development, and, consequently, also on the multiplication and diffusion of *Ips typographus*. According to the observations of KOLMODIN and HENNING, in the Orsa forests in 1914, the life cycle of the first generation covers a period of 70 days (May 16 to July 24), whereas in Germany (Tharandt) it lasts 52 days (May 30 to July 21). This difference is accounted for by the temperature. At Tharandt, according to UHLIG, the total temperatures for the 52 days was



1145°C. with an average of  $+22.02^{\circ}$ ; at Falun (the nearest observatory to Orsa) the total for the 70 days was 1151°C., with an average of  $+16.4^{\circ}$ .

*Bupalus piniarius* L. ("Tallmätaren"). — The districts which suffered most in 1916 were Nyköping (Sörby), Jönköping, Västbo (Nennesmo), Tjust, Södra Møre, and all the Kalmar district. In studying the distribution of the insect from 1889-1916, it is seen that the chief centres of attack are found in the east of Sweden, to the east and north of the 550 mm. isohyet. The atmospheric precipitation decreases as one passes from the Atlantic to the Baltic districts, and, as the rainfall decreases the possibility of development of *Bupalus* increases. The attacks of this insect are most frequent and widespread in those districts and years in which the total rainfall is below 550 mm.; this is seen from the following table.

	Average precipitation in mm.	Precipitation at the time of an attack in mm.	Decrease — %
Orebro . . . . .	577.4	458.8	20.5
Nyköping . . . . .	563.3	409.8	27.2
Gävle . . . . .	487.5	377.7	22.4
Kalmar . . . . .	434.1	368.7	15.4

*Lophyrus sertifer* Geoff. and *L. pini* L. ("Tallsteklarna"). — In 1916, these insects were observed in a few districts only — Storlandet, Luleå, Garpenberg, Halmstad, Tjust, and Lunnerbo. An examination of the chart of the distribution of *Lophyrus* in Sweden during the period 1880-1915 confirms the general diffusion of the insects from the south to the far north and, at the same time, shows clearly the influence of temperature in their development. The chief centres of attack are to the south of the isotherm  $+5^{\circ}\text{C}$ .

The following were also reported:— *Myelophilus piniperda* and *M. minor* ("Märgborrarna"); *Ips sexdentatus* Boern. ("Tolvtandade Barkborren"), *I. acuminatus* Cyll. ("Skarptandade Barkborren"); *Hylobius abietis* L. ("Snytboggen"); *Melasoma aenea* L. ("Algullbäggan"); *Agelastica alni* L. ("Blå Allövbäggan"); *Liparis monacha* L. ("Nunnan"); *Eriogaster lanestris* L. ("Björkspinnaren"); *Panolis griseovariegata* Goeze ("Tallflyet"); *Hibernia defoliaria* Cl. ("Lindmätaren"); *Tortrix resinella* L. ("Martsgallvecklaren"); *Argyresthia illuminatella* Zell. ("Granknoppsmalen") and *Lyda hieroglyphica* Christ. ("Tallkultur-Säckespinnarestekeln").

[718]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
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MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

719 — The Chemical Nature of the Vitamines. Isomerism in Natural Antineuritic Substances (1). — WILLIAMS, ROBERT, R. and SEIDELL, ATHERTON (Bureau of Chemistry, U. S. Dept. of Agriculture), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 2, pp. 431-456, 5 Diagr. + 1 Plate. Baltimore, Md., September, 1916.

RURAL  
HYGIENE

Recent investigations by WILLIAMS (*Journal of Biological Chemistry*, Vol. XXV, p. 437, 1916) demonstrated a dynamic isomerism in the hydroxypyridines which has a most profound influence upon the antineuritic properties of these substances. This fact suggested that a similar isomerism may exist in the natural "vitamines" and be responsible for the instability which has so far prevented their isolation. With this conception in mind the authors directed attention to the natural antineuritic substances of yeast and obtained results which strengthen the conjecture that an isomerism plays a determinative part in the physiological action of the natural "vitamines" not less striking than in the hydroxypyridines.

A great obstacle confronting previous investigators of "vitamines" has been the difficulty of securing adequate amounts of sufficiently concentrated products for experimental study. Since SEIDELL (*U. S. Pub. Health Reports*, Vol. XXXI, p. 364, 1916) has shown that the antineuritic substances of autolyzed yeast are completely adsorbed and retained in a physiologically active condition by fuller's earth, the authors considered that this solid combination of relatively pure "vitamine" and an inert inorganic substance, would offer greater advantages for this study than any product previously available. There is practically no loss of active "vitamine"

(1) As regards vitamins and their importance in feeding, see: — *B.* 1912, No. 1139; 1914, No. 871; 1915, No. 1239; *R.* 1916, Nos. 612 and 1254; 1917, Nos. 163 and 260; 1918, Nos. 24, 62, 125, 182, 315, 316, 377, 501, 616, 657, 662; 782 and 784 of this *Review*. (Ed.)

in the process of "activating" the solid and the small amounts of other substances adsorbed simultaneously with the "vitamine" do not appear to be of noteworthy consequence.

The results of the experiments described in this paper were the following:—

The physiological properties of autolyzed yeast filtrate were not appreciably altered by treatment with relatively concentrated caustic alkali.

In the case of fuller's earth "activated" by contact with autolyzed yeast filtrate, aqueous alkali modified the physiological action in respect to its power to maintain the weight of pigeons on a deficient diet, but did not sensibly affect its antineuritic function.

By alkaline extraction of "activated" fuller's earth a crystalline antineuritic substance was obtained, the physiological action of which was apparently not due to adhering mother liquor. On attempting to purify this substance further by re-crystallization, its antineuritic properties were lost and the resulting product was found to be identical with adenine. By suitable treatment of the resulting adenine, it acquired antineuritic properties, and the power to give a blue color with the Folin-Macallum reagent. The explanation of the results obtained appears to be that an isomer of adenine is the chemical entity responsible for the characteristic physiological properties of the "vitamine" under investigation.

*Theoretical Considerations concerning the Chemical Nature of "Vitaminines".* — Numerous writers have held the view that the "vitaminines", by which term the writers mean certain constituents of untreated foodstuffs, are complex compounds.

Accordingly various investigators have submitted products to autolysis with mineral acids as a preliminary to chemical investigation, the object of such treatment being to reduce the complex natural compounds into simpler ones which possess at least the more essential physiological characteristics of the parent substances. That hydrolysis with mineral acids does effect some change in the "vitaminines" is definitely proved by the fact that extract of rice polishings, after hydrolysis, has a distinctly altered physiological action, being much more efficacious as a curative agent than the original extract. It is only reasonable to suppose that this change results from cleavage of the original molecules. The evidence which the authors have obtained regarding the effect of alkalis on "activated" fuller's earth suggests that the alteration of physiological properties observable in this case is possibly due to a different type of cleavage. (They recognize that this change in properties is equally well accounted for by other assumptions, such as that of the existence of two types of "vitaminines" only one of which is destroyed by alkali).

Further, they have given evidence that "vitaminines" can be reduced to still simpler compounds which are physiologically active. Although the antineuritic properties of foodstuffs and of crude extracts persist through long periods of storage, it has been the experience of investigators who have attempted to isolate the "vitaminines" that the final relatively purified fractions are apparently much less stable, since simple re-crystallization may

often serve to destroy the curative property. In this paper it is shown that certain fractions of yeast may automatically lose their curative property when they are allowed to stand a few days at ordinary temperature.

These facts suggest the following hypothesis which is in part a re-statement of old conceptions. The "vitamines" contain one or more groups of atoms constituting nuclei in which the physiological properties are resident. In a free state these nuclei possess the "vitamine" activity and under ordinary conditions are spontaneously transformed into isomers which do not possess antineuritic power. The complementary substances or substituent groups with which these nuclei are more or less firmly combined in nature exert a stabilizing and perhaps otherwise favourable influence on the curative nucleus but do not in themselves possess the "vitamine" type of physiological potency. Accordingly it is believed that while partial cleavage of "vitamines" may result only in a modification of their physiological properties, by certain means disruption may go so far as to effect a complete separation of "nucleus" and "stabilizer", and if it does so will be followed by loss of curative power due to isomerization. The basis for the assumption that an isomerization constitutes the final and physiologically most significant step in the inactivation of a "vitamine" is found in studies of synthetic antineuritic products. This assumption is supported by evidence, presented in this paper, of the existence of such an isomerism in the crystalline substance.

If the above hypothesis concerning "vitamines" is fundamentally sound there are two possible successful issues of a study of the alkaline extract of activated fuller's earth; first to crystallize a free or combined curative nucleus before it has opportunity to isomerize into a non-curative substance; or, second, to isolate this nucleus in an inactive form and convert it into the active isomer, thus proving that it is related to the original antineuritic substance. Experiments described in the paper analysed show a measure of success has been attained in both of these directions.

720 - **Experimental Studies on the Food Value of Bran, in France** (1). — LAPICQUE, L. and CHAUSSIN, J., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 7, pp. 319-323. Paris, April 13, 1918.

The present percentage of flour extraction in France is between 82 and 83 %; if 85 % extraction were again adopted would the 2 or 3 % of extra flour obtained be only an inert mass, or, given that this addition increases the amount of food substance, would the benefit in food material be lost by the increased work of the intestines?

The authors previously studied experimentally on man the food value of wheat flour containing slightly more husk than white flour and found no difference in their food values (2). They again studied this question in the following form which seemed to them more conclusive:— the subject was placed on a strict maintenance diet, the greater part of which was composed of flour containing the debatable product, which was removed

(1) See R. 1918, January, No. 3; February, No. 216; March, No. 344; April, No. 379. —

(2) See R. April 1918, No. 379. (Ed.)

later on; if the product is really useless maintenance will still continue.

The subject chosen was a dog, and it was found that when the bran was withdrawn from the ration gradual starvation occurred. Consequently bran (including the products of commercial milling which are discarded in an 80 % extraction but included in a 90 % flour) is decidedly nutritious for a carnivorous animal like the dog and obviously much more so for man.

- 721 - **Determination of the Indigestible Residue *in vitro* by the Action of Pancreatin on Wheat or its Milling or Baking Products.** — DEVILLERS, I., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 17, pp. 700-702. Paris, April 29, 1918.

Investigations into the utilisation of wheat as a food have shown the inaccuracy of the proportion of wheat believed to escape assimilation in man.

As chemical methods attack wheat by too diverse actions, by forces having an action different to that of the digestive juices, and physiological methods were impracticable because of their slowness, artificial digestion was resorted to. The author describes his method of digestion by Defresne's pancreatin in the presence of sodium borate, crystallised calcium chloride, hydrochloric acid and distilled water.

The residue undigested by the pancreatin reduced to 100 parts of product dried at 105-110° was 8.26 to 12.86 for the wheats tested, 35.22 for the bran (sharps), 4.87 to 8.17 for the flours analysed, and 7.53 to 8.24 for the bread.

- 722 - ***Phymata noualhieri*, a Hemipterous Enemy of *Musca domestica* in Mexico.** — DE LA BARREDA, L., in *La Revista agrícola, Órgano oficial de la Dirección de Agricultura, Secretaría de Fomento, México*, Vol. 1, No. 7, pp. 282-284 + 1 Fig. Mexico, December 1, 1917.

At the Agricultural Station of Oaxaca (Mexico) the author observed that a branch of "lila" (*Melia sempervirens*) infested with larvae of *Phymata noualhieri* was soon covered with numerous dead flies. He bred the hemipteron, which hunted flies energetically. It is also possible that it kills them by some poisonous secretion.

AGRICULTURAL  
EDUCATION

- 723 - **A First Year Course in Home Economics for Southern Agricultural Schools in the United States.** — STANLEY, I., in *U. S. Department of Agriculture Bulletin* No. 540 pp. 1-58, Washington, D. C., July 27, 1917.

This bulletin outlines a course of study in home economics for southern high schools of the United State.

It emphasizes the connection between such instruction and actual home experience and the danger arising from formal methods of presentation. It calls attention to underlying general principles and applies them in a typical course of study, which, while based on southern conditions is applicable in other communities.

The principles involved in the 160 lessons set forth in this publication are fundamental; however, to secure the best results with this work, teachers should make a special effort to adapt the lessons to the conditions found in the homes of the pupils.

A complete course in home economics, as outlined by the American

Home Economics Association of Baltimore would include the following subjects :—

1) *Food*: (a) Selection (home-grown and purchased food). (b) Preparation. (c) Planning and serving of meals. 2) *Shelter*: (a) House sanitation. (b) Planning of house. (c) Decoration and furnishing of the house. (d) Care of the house. 3) *Clothing*: (a) Selection. (b) Making. (c) Keeping in repair. (d) Laundry work. 4) *Care and training of children*. (a) Care of a baby. (b) Problems of a young child. (c) Amusements for children. 5) *Hygiene and sanitation*: (a) Definition of health. (b) Definition and classification of diseases. (c) Means of preserving health. 6) *Home care of the sick*. 7) *Household management, including systemization of housework, expenses, accounts*. 8) *Training for the enjoyment of leisure time*.

*Outline of lessons*. — The following order has been used for each of the 160 lessons outlined in this bulletin: 1) The subject, stated as a "Problem". 2) The chief ideas, listed as Points to be brought out. 3) The references, which have been confined to material available in bulletins of the U. S. Department of Agriculture and of the various State colleges and experiment stations. 4) Under "Correlation" are suggested ways in which other courses may make use of home-economics subject matter.

724 - **Experimental Projects of the Division of Pomology of the University of California**. — HOWARD, W. L., in the *Monthly Bulletin of the California State Commission of Horticulture* (Proceedings of the 30th State Fruit Growers' Convention), Vol. VII, Nos. 1 and 2, pp. 62-64. Sacramento, California, January-February, 1918.

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

The total number of official experimental projects, in the Division of Pomology of the University of California, amounted in the autumn of 1917 to 24. Not all are located at Davis; 4 are at Berkeley, and parts of others are out in the state, namely near Gilroy, Rucker, San Jose, Vacaville, Watsonville and Hayward.

There are now on the experimental farm 55 acres of fruits used for experimentation and instruction. Experimental investigations cover pruning studies with young and old apricot trees, different methods of pruning bearing prune trees, pruning young and bearing peach trees, pruning of old and young apple and pear trees, training and shaping young apricot, cherry, plum, prune, peach and pear trees. Experiments in the summer pruning of both young and old trees are also in course.

Pollination studies include cherries, almonds, prunes, plums and pears.

The almond project consists of experiments at Davis and systematic observations over the whole state. A series of orchard soils investigations is also in progress. One part of this investigation consists of a tillage and cultivation experiment. Another part has to do with the improvement of orchard soils by means of mulching with straw and manure instead of cultivation, the tillage experiments being carried on at Davis while the mulching work is located both at Davis and in several orchards near Rucker and Gilroy.

An experiment in orchard irrigation is being carried on at Davis in cooperation with the irrigation division of the University. Peaches are being studied first; later other fruits will be added. One of the larger long-

time experiments is being carried on at Davis to determine the best or most profitable distance apart for planting apricots, cherries, peaches, pears, plums and prunes. The yield record of the orchard covering a period of 15 or 20 years or longer will determine the best or most profitable planting distances.

The cold storage studies with deciduous fruits are being carried on at Berkeley. These include the keeping qualities of grapes held at different cold storage temperatures, keeping qualities of pears in cold storage, and the keeping qualities of apples in cold storage as affected by the health and vigour of the trees and also by the stage of ripeness at harvesting time. The new Agriculture Building, Hilgard Hall, at Berkeley, has the best experimental cold storage plant in the United State.

Six new projects deal with fruit drying problems. These include a survey of the fruit drying industry of the state; variety tests of fruits for drying purposes; standardization of fruit drying methods, equipment for drying, effects of finishing in the shade by stacking the trays, and effects of sulphuring on fruit tissue and its possible relation to palatability of product. Extensive data along these lines were collected during the last season.

At Davis extensive studies of fruit bud development are in course.

Special studies are being made with walnuts, pecans, chestnuts, filberts and pistachio nuts.

Variety tests of all kind of fruits are being made. The best collections of varieties are: peach 85, apricot 40; cherry 40; almond 30; pear 30.

Under miscellaneous experiments might be mentioned work in spraying; various tests with small fruits, including both bush fruits and strawberries; individual trees performance records; a collection of phenological data with all fruits; trials with tree washes against borers and rabbits, washes for protecting pruning wounds, etc.

The division keeps an individual record in map form and card index form for every fruit tree that is growing in the University Farm orchards. The orchards are being conducted both for experimental and instruction purposes.

## CROPS AND CULTIVATION.

### AGRICULTURAL METEOROLOGY

725 — **Agricultural Meteorology in New Castile, Spain.**—QUINTANILLA, G., in the *Boletín de Agricultura Técnica y Económica*, Year X, No. 110, pp. 115-132. Madrid, February, 1918.

The average yield per acre of cereals in New Castile is:—wheat, 5.80 cwt., barley, 10.74 cwt., oats, 6.29 cwt., and rye, 6.03 cwt. The figures for the province of Cuenca alone are:—wheat, 4.93 cwt., barley 9.66 cwt., oats and rye, 4.38 cwt.

The ignorance of the farmers, the absence of modern machinery and chemical fertilisers are not sufficient to explain these remarkably poor crops. The primary cause is to be found in the unfavourable climatic conditions. Spanish emigrants, especially Castilians, in a more favourable climate, with the same labour, tools, and methods produce at least double the quantity of wheat as in their own country. Agricultural meteorology,



the importance of which is recognised throughout the world, assumes an especially urgent character in Spain.

The following data are available on the weather conditions of New Castile :—

**TEMPERATURE.** — Fundamental characteristics :— short growing season and considerable annual variations in temperature. The author calls “ persistent ” frosts those which occur regularly each year, “ rare ” those which occur less frequently, *i. e.*, one in every two, three, or four years on the average.

In the province of Guadalajara “ persistent ” frosts occur from November to April, “ rare ” frosts occur in October and May. In the province of Cuenca “ persistent ” frosts continue from November to May and “ rare ” ones occur in October and June. Only the months of July, August and September are consistently free from frost. In the province of Madrid “ persistent ” frosts occur from November to April, and, more rarely, occur also in October and May. At Toledo the duration of frosts is from November to March, and the season consistently frost-free includes the months of May, June, July, August and September.

The short frost-free season (the conditions in the province of Cuenca are very similar to those of northern Sweden) suffers seriously from drought, marked annual variations, and frequent very high temperatures. The maximum and minimum temperatures for the last 5 years are :— Madrid  $+40.5^{\circ}$  and  $-14^{\circ}$  C. ; Cuenca  $+38.5^{\circ}$  and  $-12.5^{\circ}$  C. ; Toledo  $+40.4^{\circ}$  and  $-6.5^{\circ}$  ; Guadalajara  $+39.6^{\circ}$  and  $-13^{\circ}$ .

**RAINFALL.** — Madrid, 417 mm. ; Cuenca, 477 mm. ; Toledo, 361 mm. ; Guadalajara, 410 mm. This would be a sufficient amount of rain if it were evenly distributed, and would ensure a good cereal harvest. The distribution of the rain does not, however, always correspond to the requirements of the crops, and frequently the lack of water at the critical period (earring for cereals) contributes not a little to a low yield. The weather conditions most unfavourable to crops in Spain are, therefore, frost and drought. In order to control these factors it is above all necessary to know exactly their distribution and frequency so as to choose the most suitable varieties, determine the periods for ploughing, etc. The attention of the Minister of Agriculture, of the Society of Spanish Agriculturists and of all agricultural societies, is drawn to the interest presented by this subject and the formation of a service with a technical staff and equipment, fitted to deal with the problems so closely touching Spanish agriculture is demanded. Methods of dealing with the climatic and agro-geological conditions of the Peninsula are also suggested.

**CHOICE OF RESISTANT TYPES.** — By selection and hybridization there have been obtained in Sweden, Canada, the United States, etc., types of wheat, barley and oats particularly resistant to low temperatures. Acclimatization experiments in Spain with Russian and American varieties have given almost entirely negative results. In Spain, as elsewhere, it would probably be wiser to use local varieties, apply pure strain selection first and eventually improve them by hybridization and selection. Among the nat-

ive varieties are some six-rowed barleys which have given results superior to those obtained with foreign varieties in all comparative cultural tests.

PERIOD FOR SOWING. — Taking as a basis observations made at Alcala Henares the author, though on the whole in favour of early sowing, finds it impossible to give a fixed date on account of the unsettled weather conditions. In some years the maximum temperature ( $40^{\circ}$  C. in the shade) occurs during the second fortnight in June; in this case sowing should be done as soon as possible so that the wheat may ripen before the great heat. In other years wheat, if sown early, regularly suffers from frost, which attacks the young plants even at a very advanced stage of growth.

CHOICE OF SOIL AND CULTURAL METHODS. — Thorough weeding, surface cultivation, the use of chemical fertilisers which increase the concentration of the soil solution, are all efficient methods of controlling drought, but in any case it is essential that the arable layer should have a certain depth below which a good harvest cannot be obtained even if the best methods are adopted.

The author lays stress on the necessity of such examinations of the soil which will immediately give the data by which it is possible to calculate approximately the probability of growing successfully any crop in a country with so unfavourable a climate.

726 - **Orchard Heating Against Frost in Utah, U. S. A.** — WEST, F. L., and EDLEFSEN, N. R., in *Utah Agricultural College Experiment Station, Bulletin* No. 161, pp. 1-47 + 2 Figs. Logan, Utah, October, 1917.

In the States of Florida, Ohio, Washington, Colorado, and California and Oregon in particular, the protection of orchard trees against frost by heating with heavy oil has been adopted on a large scale with distinctly positive results. In Utah, every three years out often the fruit crop is reduced by spring frosts, so that the question of protection by heating should not be neglected, but it must first be shown whether it would prove economically practical. To decide this it is necessary to determine for each species of fruit tree:—1) the average number of times the fires must be lit and the expense entailed; 2) the amount and price of the fruit thus saved. The study made on this subject by the author from data supplied by five of the most important fruit centres (Utah, Box Elder, Salt Lake City, Weber, and Cache) leads to a negative conclusion as is shown by the results given below.

NUMBER OF TIMES THE FIRES SHOULD BE LIT. — The critical period for fruit trees with respect to frost coincides with the interval between the beginning of flowering and setting. Table I gives the figures concerning apple, apricot, cherry and peach trees collected by the Agricultural Stations of Provo (Utah), Corinne (Box Elder), Salt Lake City, Ogden (Weber), and Logan (Cache). Table II shows the number of times which, according to the author, it would have been necessary to light the fires. In the case of the peach trees they should be lit an average of three times a year.

EXPENDITURE AND PROFIT. — For the peach tree, taking as a basis the calculations drawn up with the greatest care, the total annual expenditure is \$ 50.50 per acre. The average yield is 400 bushels per acre, and the loss

due to frost about 80 bushels (20 %) to a net value of \$ 28 (the average price of peaches on the Utah market is about \$ 0.55 a bushel).

The figures would be slightly better for apple but it must be remembered that in this case too, the number of heatings proposed by the author represents a minimum which would always be much exceeded in reality as a precaution, as is proved in all orchards fitted up with the necessary apparatus.

This study shows that the advisability of heating and fumigating Utah orchards at the present price of fruit and fuel is doubtful, for the benefit obtained would hardly cover or justify the expense, even under the most favourable conditions of good weather forecasting and capable staff.

TABLE I. — *Duration of the interval between the beginning of flowering and setting (average 1920-1916).*

Station	Apicot.	Peach	Cherry	Apple.
Provo, Utah . . . . .	—	Apr. 1-Apr. 30	—	Apr. 14-May 15
Corinne, Box Elder . . .	Apr. 1-Apr. 15	Apr. 6-Apr. 20	Apr. 10-Apr. 30	Apr. 30-May 18
Salt Lake City . . . . .	—	Apr. 14, Apr. 30	—	Apr. 25-May 16
Ogden, Weber . . . . .	—	March 8-March 31	—	Apr. 3-Apr. 19
Logan, Cache. . . . .	—	Apr. 21-May 5	—	May 7-May 18

TABLE II. — *Minimum number of times for lighting the fires each year (average).*

	Provo	Corinne	Salt Lake City	Ogden	Logan	Average for the 5 localities
Peach . . . . .	5.7	2.2	2.2	5.0	0.5	3.1
Apple . . . . .	2.9	0.5	1.0	0.3	0.2	1.0
Apicot . . . . .	—	3.2	—	—	—	3.2
Cherry . . . . .	—	1.5	—	—	—	1.5

727 — *Soil Acidity and the Hydrolytic Ratio in Soils.* — SPURWAY, C. H. (Assistant Professor of Soil Physics, Michigan Agricultural College), in the *Journal of Agricultural Research*, Vol. XI, No. 12, pp. 659-672 + Bibliography of 9 Publications. Washington, December 17, 1917.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

Recent studies (1) have shown a certain relationship between the acidity of a soil, as shown by a litmus or phenolphthalein indicator, and its content in aluminium and iron compounds. The author's investigations into glacial soils showed a connection between the aluminium and iron salt content of the soils and their reaction to the above-mentioned indicators. In determining for 29 soils the percentage of calcium, iron, aluminium and silica soluble in N/5 hydrochloric acid a definite relationship was found between the ratio of calcium to iron or aluminium soluble in N/5 hydrochloric

(1) See B., 1914, No 980; R. 1916, Nos 727 and 1163. (Ed.)

acid and the soil reaction. All soils with a ratio  $\frac{\text{lime}}{\text{ferric oxide} + \text{aluminium}}$  exceeding  $\frac{1}{1.3}$  are acid and those in which this ratio is lower are alkaline. There is, therefore, reason to believe that the reaction of the soils studied depends chiefly on the hydrolytic ratio between the hydrolysing compounds of alkali soils and those of iron and aluminium.

It is thus possible to determine the amount of lime required to neutralize acid soils by estimating the amount required to bring the soluble calcium content to the ratio  $\frac{\text{lime}}{\text{ferric oxide} + \text{aluminium}} = \frac{1}{1.3}$ . Amounts calculated by this process are very near to those determined by an indirect titration method proposed by the author, so that the two methods corroborate each other. The new process consists in treating increasing quantities of soil with an invariable quantity of titrated lime water and determining the reaction of the solutions with phenolphthalein and their electrical resistance. The amount of lime required to neutralize an acid soil is independent of its concentration, thus proving neutralization to result from a chemical reaction. Nevertheless soil still absorbs lime after neutralization, but by physical means. It is, however, possible that a mass action may cause chemical reactions in the presence of an excess of lime.

**728 - Salts Injurious to Vegetation and their Relationship to the Irrigation of Arid and Semi-arid Regions.** — PERKINS, A. J. (Director of Agriculture), in *Department of Agriculture of South Australia, Bulletin* No. 103, pp. 24. Adelaide, 1916.

Present Australian irrigation areas, and in particular those situated on the banks of the Murray, are under the influence of arid conditions of climate. Land so situated will become exceedingly productive when brought under cultivation and irrigated. Experience throughout the world, however, teaches that all such land, when brought under the influence of irrigation, is liable to become salt-impregnated to the extent of barrenness. At times, when first handled, such land shows no apparent signs of the presence of salt; salt, however, is present, but distributed evenly and invisibly through the depth of several feet of soil. A few seasons subsequent to the application of irrigation, salt may become apparent either uniformly throughout a block, or in scattered patches which gradually increase in area. This salt has risen to the surface through surface evaporation; and, knowing this, it is the business of irrigators to do everything in their power to hinder the action of surface evaporation and hold in check the rise of salt.

Towards this end the tillage of irrigated areas, when given in the way of initial preparation of the soil, must be deep and thorough, infinitely more so than is the case in the average routine of farming. In addition to this it is essential to keep the surface soil well screened from the direct rays of the sun during the summer months and where circumstances do not permit of this the moister layers of the subsoil must be kept well-protected by a deep layer of soil mulch. Nor should this be forgotten in autumn, when irrigation areas are bare, in the interval that lies between the removal of the summer crop and the seeding of the winter crop.

Over-irrigation, leaky water channels, shallow drainage channels, and the slow removal of salt-impregnated drainage waters must be avoided.

Irrigation waters that are unduly charged with soluble salts must be avoided. Irrigation water showing 20 grains of soluble salts to the gallon, and used on the 3 acre feet basis, will add to the soil annually more than one ton of soluble salts to the acre; 40 grains to the gallon nearly  $2\frac{1}{2}$  tons to the acre and so on. A portion of these salts will no doubt be taken up by the plants; another portion, however, will go towards swelling the existing stocks of injurious salts originally present in the soil.

If, in spite of these precautions, it is impossible to prevent the ultimate rise of salt, or again, if from the outset the land is evidently over-charged with surface salts, special steps towards the removal of the salts must be taken. Whatever steps may eventually be decided upon, none are likely to prove effective unless adequate provision is made for the systematic removal of drainage waters. Naturally, pipe drainage should be avoided if possible. Ultimately, however, in many cases it will be necessary to determine whether the cost of establishing an adequate system of pipe drains is not amply set off by the extremely high productivity of land so treated and irrigated under arid conditions of climate.

If the land shows 0.1 per cent of sodium carbonate it should be treated with gypsum prior to leaching operations. This, however, is a contingency rare in local experience; under Australian conditions the flood waters pass through the soil, dissolve the soluble salts, and convey them without hindrance through the drain pipes into the country drainage.

The profits resulting from properly conducted irrigation operations under Australian conditions of climate are enormous; the indirect advantages to the State as a whole are equally great. If, however, Australian irrigators are not prepared to take into account this important salt question, and to guard themselves adequately against it, all the expenditure of time and capital will in the end prove vain, and the irrigation areas will revert to the condition of those of Mesopotamia.

#### 729 - The Effect of Certain Factors on the Carbon Dioxide Content of Soil Air. —

BIZZELL, J. A. and LYON, T. L. (Contribution from the Laboratory of Soil Technology, College of Agriculture, Cornell University, Ithaca, N. Y.), in the *Journal of the American Society of Agronomy*, Vol. X, No. 3, pp. 97-112 + 9 Figs. Washington, March, 1918.

Some higher plants are said to influence certain bacterial processes in the soil, such as stimulating nitrate formation during the most active period of their growth. Later, however, they have a depressing effect, and, since the conditions which favour the formation of carbon dioxide in soils are similar to those favouring nitrification, these two processes may be supposed to be parallel to each other. This is the opinion of many workers (1).

All determinations hitherto made, however, lack uniformity on account of the different conditions under which they were carried out and the various methods employed. The author, therefore, undertook a series of experiments in large lysimeter tanks, which received no other moisture

(1) See R. 1917, No. 795. (Ed.)

that from rain. The samples of air were removed from their drainage tubes. Some of the tanks were filled with clay loam, others with silt loam.

In clay loam oat crops produced great fluctuations in the carbon dioxide content of the soil air. The greatest apparent production was at the flowering period. This was followed by a marked decrease of  $\text{CO}_2$  which appeared to be due to the depressing effect of the crop on the production of  $\text{CO}_2$  by bacterial action.

In silt loam the crop apparently produced little effect on the formation of carbon dioxide, whereas the addition of lime caused a increase in the  $\text{CO}_2$  content of the air of both cropped and uncropped tanks, through in clay loam liming produced no such effect.

In silt loam burnt lime caused a larger production of  $\text{CO}_2$  than the chemically equivalent quantity of ground lime.

The results do not make clear whether the increased  $\text{CO}_2$  production caused by burnt lime is due to a stimulation of bacterial activity or stimulation of the crop:

730 - **The Relation of Weed Growth to Nitric Nitrogen Accumulation in the Soil.** — CALL, L. E., and SEWELL, M. C., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 35-44 + 7 Tables + Bibliography of 19 Publications. Washington, January, 1918.

The favourable effect of tillage upon nitrification is generally attributed to the incorporation of organic matter, the distribution of bacterial flora, aeration, and moisture. The authors attempt to prove that too much importance has been attached to these factors and that the good effects of tillage are due above all to the destruction of weeds which might absorb the nitrates.

After reviewing the publications on this subject (which show that nitrification is not essentially increased by greater aeration and a higher water content, though these factors are necessary) the authors give the results of various experiments made at the Kansas Agricultural Station during several years on plots of wheat cultivated by eleven different methods. A comparison of the yields, moisture contents and nitrate contents shows that marked differences in yield cannot be attributed to the water content which is nearly always constant, but that there is a close relation between yield and nitrate content. Experiments conducted by the authors themselves showed that the accumulation of nitrates is much larger in soils free from weeds even when such soils are not farmed. They conclude that, in a sufficiently light soil, much labour may be saved by adopting only the essential cultivation processes and destroying the weeds by other methods such as rotation and grazing by livestock, especially sheep.

731 - **Protozoa and the Phenomena of Reduction in Soil (1).** — VON WOLZOGEN KÜHR, JR., C. A. H. (Bacterioloog aan de Cultuuraafdeeling te Pasoeroean), in *Archief voor de Suikerindustrie in Nederlandsch Indië*, No. 27, pp. 1125-1182 + 11 Figs. + Bibliography. Soerabaja, 1917.

The principal biochemical reduction phenomena occurring in the soil and the analytical methods for recognizing them are rapidly reviewed.

(1) See B., 1915, No. 786. (Ed).

When they have reached a certain intensity these reduction phenomena result in changing ferric into ferrous compounds; the best reagent for recognizing these phenomena is potassium ferricyanide. Quantitative determinations include: — 1) the “*reduction index*” (“*reductiegetal*”), expressed in cc. of a decinormal solution of  $\text{KMnO}_4$  required to oxidise the quantity of “ferrous” iron liberated by 100 gm. of soil (dried at  $105^\circ\text{C}.$ ) in a sulphurous solution; 2) the “*ferro-index*” (“*ferro-cyfer*”), expressed in cc. of a decinormal solution of  $\text{KMnO}_4$  required to oxidise the “ferrous” iron extracted from 100 gm. of soil (dried at  $105^\circ\text{C}.$ ) in an acetic solution.

The recent publications on soil protozoology (CUNNINGHAM and LÖHNIS, RUSSELL and HUTCHINSON) (1) (FRANCÉ) are reviewed. These studies show that a high water content favours the appearance of protozoa; in the same way as an excessive water content also favours the phenomena of reduction in the soil the presence of more numerous protozoa (amoebae, flagellates, ciliates) may serve as an index to show reduction processes. It is relatively easy to determine the number of protozoa present in 1 gm. of soil, since sterilisation precautions as rigorous as those required when the bacteria are counted are no longer necessary, and many methods have been described (CUNNINGHAM and LÖHNIS, KOCH (2), Kopeloff (3)). The examination of numerous soil samples has shown that, from a point of view of the number of protozoa present and the degree of reduction, soils may be divided into three classes:—

- 1) *Good soils*, showing little or no reduction, containing few or no protozoa (from 0 to 50 protozoa per 1 gm. of soil);
- 2) *Bad soils*, with a high “reduction index” and many protozoa (50 to 100 or more per gram);
- 3) *Very bad soils* with a very high “reduction index” and few or no protozoa (0 to 50 per gram).

It is seen that, as the reduction process continues, the number of protozoa increases, reaches a maximum, then decreases. This phenomenon may be represented graphically by curves called “*curves of protozoa reduction*” (“*protozoënreductiekrommen*”) specially designed for each of the reduction processes: — cellulose fermentation, reduction of the sulphates and butyric fermentation.

As the protozoa are aerobic, their number increases during the first stages of the reduction phenomena, then they feed on anaerobes and the aeration of the soil is sufficient. As the reduction process continues, the anaerobes increase and the air decreases, till the development of the protozoa is checked and the maximum reached. Finally, during the continuation of reduction, the activity of the anaerobes increases to such an extent that the protozoa decrease more and more and die, being also attacked by the toxic substances formed during reduction, such as volatile fatty acids, sulphuretted hydrogen, etc. The number of protozoa present in 1 gm. of soil can show the reduction process to which the soil is subjected. Butyric

(1) See B., 1915, Nos. 460 and 1250. (Ed.) — (2) See, R., 1916, No. 269; — (3) See B., 1915, No. 1122. (Ed.)

ferments especially are fatal to protozoa as butyric acid kills them. The reduction curve is also very low (limited number of protozoa). During the reduction of sulphates, however, a large proportion of the sulphuretted hydrogen combines with the iron, the protozoa suffer less and are very numerous.

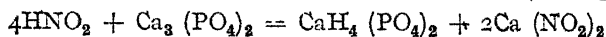
Protozoa form, therefore, a biological indicator of the reduction phenomena in the soil which the author applied to a large number of soils from sugar-cane plantations in Java. These investigations have shown that there is a relation between the water content, "reduction index", "ferro-index", and the number of protozoa per gram of soil.

**732—The Influence of Nitrifying Bacteria on Phosphates.**—HOPKINS, C. G. and WHITING, ALBERT L., in *University of Illinois Agricultural Experiment Station, Bulletin No. 190*, pp. 395-406. Urbana, Illinois, June, 1916.

The purpose of the experiment herein reported was to determine whether the farmer supplying nitrogen to his soil in the form of organic matter could depend upon its decomposition to render soluble the finely ground rock phosphate, and so maintain the necessary supply of available phosphorus. Two experiments were carried on; the first for the purpose of testing the ability of nitrite bacteria to dissolve pure rock phosphate; the second in order to test the effect of nitrate bacteria on pure tricalcium phosphate. The methods of determination consisted in measuring by chemical analysis, in the first instance, the amount of nitrogen which they had changed from ammonia to nitrite, in the second one the amount of sodium nitrite which they had changed to nitrate, and in both cases the amount of phosphorus and calcium which had at the same time made soluble.

The results are summarized as follows:—

Nitrite bacteria make phosphorus and calcium soluble from insoluble phosphates when they oxidize ammonia into nitrite. About one pound of phosphorus and about two pounds of calcium are made soluble for each pound of nitrogen oxidized, aside from the action of the acid radicles associated with the ammonia. The ratio of solubility found on the basis of nitrogen to phosphorus and calcium conforms to the following reaction:



According to this equation, 56 pounds of nitrogen liberate in soluble form 62 pounds of phosphorus and 120 pounds of calcium.

Plants are important factors in the liberation of phosphorus, owing to the production of carbon dioxide and the removal of the soluble phosphorus produced by the bacteria.

Neither ammonia-producing bacteria nor nitrate bacteria liberate appreciable amounts of soluble phosphorus from insoluble phosphates. Other acid-producing bacteria make phosphorus soluble from insoluble phosphates according to the nature and amount of the acid produced.

A comparison of the amounts of nitrogen, phosphorus, and calcium required by farm crops with those possible of solution by biochemical action (see the appended table) shows possibilities far beyond the plant requirements; which leads to the conclusion that plenty of rock phosphate



in contact with decaying organic matter must give the plants an excellent opportunity to obtain both phosphorus and calcium as well as nitrogen.

*Phosphorus, Calcium and Nitrogen Required by Crops, Compared with that Possible of Solution When Nitrite Bacteria Act upon Tricalcium Phosphate.*

Crop	Nitrogen	Phosphorus		Calcium	
	Lb. Required	Lb. Required	Lb. Possible	Lb. Required	Lb. Possible
<i>Maize</i>					
Grain, 100 bus . . . . .	—	—	—	—	—
Stover, 3 tons . . . . .	—	—	—	—	—
Cobs, ½ ton . . . . .	150	23	166	22	321
<i>Wheat</i>					
Grain, 50 bus . . . . .	—	—	—	—	—
Straw, 2 ½ tons . . . . .	96	16	107	11	206
<i>Oats</i>					
Grain, 100 bus . . . . .	—	—	—	—	—
Straw, 2 ½ tons . . . . .	97	16	108	17	208
<i>Timothy, 3 tons . . . . .</i>	76	9	84	20	163

733 - Changes in the Nitrogen Content of Stored Soils. — ALDRECHT, W. A. (Contribution from the Department of Soils, University, of Missouri) in the *Journal of the American Society of Agronomy*, Vol. X, No. 2, pp. 83-88 + Bibliography of 7 Publications. Washington, February, 1918.

Determinations showed that wet or dry samples of soil stored in or near a laboratory in containers not hermetically closed risk contamination from ammonia. Moreover, when wet soils are allowed to dry slowly bacterial action seems to affect the nitrogen content very little. The ammoniacal nitrogen contained in the soil is held by a purely physical adsorption phenomenon, not by moisture.

734 - Report on Irrigation Surveys and Inspections in Canada for 1916-17. — I. DRAKE, E. F. (Superintendent of Irrigation), Report of the Superintendent. — II. PETERS, F. H. (Commissioner of Irrigation and Chief Engineer), Report on Irrigation and Canadian Irrigation Surveys, in *Department of the Interior of Canada*, pp. 79 + 8 Diagrams + 1 Plan + Bibliography of 14 Publications. Ottawa, 1917.

The report of the Irrigation Branch of Canada for the year ending March 31, 1917, includes 2 reports.

The first is by Mr. E. F. DRAKE, who deals briefly with the state of irrigation development, with hydrometric surveys (the territory covered by this work is divided into 13 districts, each in charge of an engineer, who, with one helper and the necessary gauge observers, performs all the field work; during the open water season, 177 gauging stations were maintained. records being taken at 138 gauges on irrigation canals and ditches; during

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the winter, 84 stations were maintained) and drainage (projects, subsidies and legal agreements).

The second report, by Mr. F. H. PETERS, deals with the organization of the staff, office work, hydrometric work and the study of irrigation projects 1) for land lying east of Macleod (using the Oldman river), of an area of 25 000 acres and at an estimated cost of \$ 228 000 ; 2) for the Taber district, Alberta (17 000 acres) ; 3) for the Lethbridge Northern District (area of 97 531 acres ; estimated cost \$ 2 274 316) ; 4) for land situated in the basins of the Milk and St Mary rivers (a project requiring a Treaty between the United States and Canada ; area of over 500 000 acres, for which 7 different irrigation schemes are described).

The inspection of the irrigable lands in the Eastern Section of the Canadian Pacific Railway Company's Irrigation Block, begun in 1913, was completed in 1916. About 130 240 acres were inspected. Experiment plot work was carried out at Strathmore and Ronalane (Alberta) on the amount of water required to obtain the highest yields of alfalfa, clover, wheat, oats, barley, peas, potatoes, maize, turnips, timothy, etc. Further information on the same subject was obtained at Coaldale, near Lethbridge, and crop reports were obtained for the Cypress Hills District, Saskatchewan, and for Calgary, Alberta.

The results of the experiments are given in numerous tables.

735 - **The Colorado River and its Utilisation.** — I. LA RUE, E. C., in *U. S. Department of the Interior, Geological Survey, Water-Supply Paper*, No. 395, pp. 231 + 5 Figs. + 25 Plates. Washington, 1916. — II. GRUNSKI, C. E., in *U. S. Senate, 65th Congress, 1st Session, Document No. 108*, pp. 38. Washington, 1917.

I. — The U. S. Geological Survey was the first to study the hydrography of the Colorado basin by establishing gauging stations on the Gila River, at Buttes, Arizona, in 1889. Since then all the services (5) of the various federal government departments interested in the subject have collaborated in a study of the water-system of the Colorado or have studied it separately from different points of view. Mr. LA RUE has collected the many observations made so as to present a more complete consideration for the best methods of utilising the Colorado river, the course of which is 2200 miles

After describing the physical conditions of the Colorado basin the author gives historical notes on the various explorations of the river from 1531 to 1911, and a hydrographical and geological bibliography of the basin. In his study on the system of the river and its tributaries the author gives in a series of tables the output of each of them according to observations made from the beginning. The present state of irrigation of the Colorado basin is described and a detailed examination made of the river and its tributaries, the possibility of increasing the area irrigated by building numerous weir reservoirs, the regulation of the water courses and construction of canals.

In 1913 the area irrigated by the river and its tributaries was 1 581 000 acres in the United States and 50 000 in Mexico, or 1 631 000 acres in all,

According to the author it would be possible to irrigate 4 002 000 acres in the United States and 897 000 acres in Mexico, or 4 899 000 acres in all.

The unused motive power is estimated at 2 666 910 H.P. At the present time 25 hydro-electric works develop 77 525 H.P. in the Colorado basin.

The author also studies the regulation of the river and its tributaries so as to avoid floods. He values at \$ 30 000 000 to \$ 50 000 000 the value of land subject to damage from floods in the Imperial Valley, and at \$ 10 000 000 to \$ 15 000 000 the land requiring protection between Bulls Head Rock and the frontier. The extent and frequency of the floods are also examined.

II. — Mr. C. E. GRUNSKY, whose study was presented to and published by the U. S. Senate, re-examines the possibility of developing irrigation in the Colorado basin. He studies not only the old projects and the present concessions granted to irrigation companies, but thoroughly examines the international point of view and the collaboration between the United States and Mexico to solve the difficulties concerning the regulation of the Colorado river and the quantity of water to be delivered to Mexico by any diversion canal below Pilot Knob. All the questions touching on an agreement between the United States and Mexico on this subject are enumerated.

736 — **Schemes for Barrage-Reservoirs in Tunis.** — COIGNET, J., in *L'Hydraulique en Tunisie*, pp. 143, 2 Tables, 3 Diagrams, 2 Plans + 3 Maps. Tunis, 1917.

After considering the need for utilising the surface water in Tunis by making great barrage-reservoirs, the author quotes objections to the construction of works holding up the water of rivers that do not flow all the year round or of beds that are in flood a few times only each year. Besides the benefit to agriculture barrages would, with the systematization of the watercourses, furnish motive power for various industries as well as drinking water for towns and centres of colonization.

The author describes the chief dams he has studied, amongst which he mentions :—

1) The barrage-reservoir of Hamman Zriba destined to complete the drinking water supply of Tunis and neighbourhood as well as to provide drinking and irrigation water for the centres of colonisation situated down stream from the barrage. This reservoir to be constructed on the Oued El-Hammam at the entry of the Zriba gorges will cover an area of 95 hectares and store 11 430 000 cu. metres of water. The reservoir will annually receive about 20 000 000 cu. metres. The height of the barrage will be about 100 ft.

2) The barrage-reservoir on the Oued Gerond which can hold 40 000 000 cu. metres, giving a delivery of 12 500 litres per second. The height of the dam is about 143 ft.

The area that could be irrigated with 4000 cu. m. per hectare (cereals) would be about 100 000 hectares situated chiefly between Kairouan and Sousse. This dam would admit of developing a force of 5 000 HF. Its construction would, however, encounter certain technical difficulties, chiefly

in the displacement of the railway. In fact, the project necessitates the submersion of the Rahrmate tunnel.

3) The systematization of the Medjerdah with the construction of 2 large barrage-reservoirs at Oued Tessa and Testour and the utilisation of the barrage-bridge of El-Bathan, which would allow of irrigating all the outskirts of Tunis and of 50 000 hectares between Testour and Grombalia. The statistics of the areas to be irrigated and the quantities of water required indicate only 27 000 hectares for the Medjerdah for the first few years, but as the Testour reservoir will provide 430 000 000 cu. m., the irrigation area can be afterwards increased by about 30 per cent.

The author gives interesting information regarding other projects of barrage-reservoirs to be constructed on the rivers Kasseb, Mellegue, Boul Kebir, Koceine, Masri (O. Melah) and Chiba, and Sedjanne, the execution of which would allow of irrigating a large area.

In conclusion, the author insists upon the urgent need for immediately constructing barrage-reservoirs in Tunis so that the country can replace or procure at least a part of the indispensable products that are generally lacking.

737 - **Irrigated Farms in Utah, U. S. A.** — Sec No. 811 of this *Review*.

738 - **Cultural Methods in Apple Orchards in Indiana, U. S. A.** — Sec No. 768 of this *Review*.

739 - **The Decomposition of Green and Stable Manures in Soil.** — POTTER, R. S. and SNYDER, R. S. (Assistant Chief and Assistant in Soil Chemistry, Iowa State College Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 13, pp. 677-698 + 9 Figs + Bibliography of 8 Publications. Washington, December 24, 1917.

This paper is a continuation of previous studies (1) the principal aim of which was to determine the rate of decomposition of original or added organic matter in soil by estimating the amount of carbon dioxide evolved from manured soils. The last experiments were made in two series — one with applications of calcium carbonate, the other with liming.

The principal results show that the organic matter in soil decomposes more rapidly in soil treated with calcium carbonate or lime than in untreated soil. The decomposition of the total organic matter of a soil treated with stable manure or green manure (clover or oats) is hastened by the addition of calcium carbonate or lime.

Stable manure seems to hasten slightly the decomposition of green manures accompanying it, and these two forms of manure help to preserve the lime in the soil. No appreciable difference was noted in the rapidity of decomposition of green manures when applied dry and as a fine powder or fresh and in large pieces.

740 - **Sulphuric Acid and Fertiliser Industries in the United Kingdom.** — I. *The Board of Trade Journal*, Vol. C, No. 1110, pp. 268-271. London, March 7, 1918. — II. *The Chemical Trade Journal and Chemical Engineer*, Vol. LXII, No. 1607, pp. 203-207. London, March 9, 1918. — III. *Mark Lane Express Agricultural Journal*, Vol. CXIX, No. 4511, p. 258. London, March 11, 1918.

A Committee was appointed by the British Minister of Munitions in

(1) See R., 1917, No. 9. (Ed).

February 1917, to consider and report on the position of the sulphuric acid and fertiliser trades as affected by the new acid plants which have been erected during the war by the Ministry of Munitions.

From the report just issued it appears that the production of sulphate of ammonia and of phosphatic manures before the war provided the principal outlets for sulphuric acid, these two industries absorbing about 60 % of the pre-war production.

In consequence of the progressive introduction of by-product coking the output of ammonia was steadily increasing, and at the outbreak of the war amounted to 400 000 tons per annum expressed as sulphate. About 15 % of this production was not marketed in the form of sulphate, but was converted into other ammonia products. The home consumption of sulphate of ammonia for agricultural purposes was only 60 000 tons per annum, and the remainder was mainly exported.

For some years before the war the manufacture of superphosphate in the United Kingdom was in a very unsettled condition owing to the rapidly increasing importations of foreign manufacture and the gradual decline in the export trade. The export of superphosphates had reached a maximum of 160 000 tons in 1911, but had afterwards declined to 63 000 tons in 1913. The cause of this decline is to be sought partly in the erection of superphosphate plant in countries which previously imported this fertiliser, and partly in the competition of continental countries which, with the aid of cheap by-product acid from zinc manufacture, and in some cases with specially favourable freight conditions, succeeded in displacing their less favourably situated British competitors.

The United Kingdom possesses no natural advantages for the manufacture of superphosphates, since both pyrites and phosphates have to be imported as raw materials. It is, therefore, natural that when the consumption of superphosphate in countries such as Spain and Portugal reaches a certain point, local manufacture is undertaken, and, with the advantage of proximity to the raw material, soon succeeds in overcoming the competition of imported superphosphate from less favourably situated countries.

The expansion in the production of ammonia during the war has been somewhat accelerated owing to its association with the by-product coking industry. The production of sulphate of ammonia has, however, suffered a temporary decline, owing to the diversion of large quantities of ammonia to the production of nitrate of ammonia. In view of the requirements of sulphuric acid for explosives manufacture, plants have been erected on a considerable scale for the conversion of crude ammonia into concentrated ammoniacal liquor. A substantial proportion of the requirements of ammonia for munitions purposes have thus been purchased in a form which requires no sulphuric acid for its manufacture. The total production of sulphate has thus been temporarily reduced from 350 000 tons to a little over 250 000 tons.

At the same time, there has been a large increase in the home consumption for agricultural purposes, owing to the substitution of this fertili-

ser for nitrate of soda, the entire supply of which has been required for explosives manufacture. The export trade has nearly disappeared, the only exports now allowed being relatively small quantities to Allied countries and British Possessions.

The production of superphosphate has been greatly reduced during the war owing to the lack of sulphuric acid. The production of superphosphate in 1916 fell to about 500 000 tons, as compared with about 800 000 tons in 1913. During the last few months, however, the paramount necessity of increasing the home-grown food supply has been realised, and steps have been taken to secure a large and immediate production of superphosphate. Renewal and extension of superphosphate plant is accordingly proceeding at the present time with a view to recovering the lost ground as speedily as possible.

After hearing the evidence and considering the figures which have been laid before them, the Committee concluded that by far the most important prospect of utilising the increased quantities of acid is in the manufacture of artificial fertilisers.

With regard to sulphate of ammonia, which before the war was largely an export trade, it is probable that the impetus which has been given to home consumption will continue to be felt. It must be remembered, however, that the probable increased home consumption, will to a very large extent be provided by a reduction of the export of this fertiliser below the pre-war figures. The limiting factor is at present the amount of coal carbonised in connection with recovery plant, and the acid consumption for sulphate manufacture bears a direct relation to this quantity, and not to the home consumption. During the war, although every effort has been made to extend by-product coking plants, the increased production of ammonia has only been about 7 per cent. The coke-oven industry may be expected to absorb larger quantities of acid during the years following the war, but the increase can hardly be considered of much importance to the acid situation.

The manufacture of ammonia from atmospheric nitrogen by the cyanamide process and by the Haber process may ultimately assume importance in the United Kingdom, but as the success of these processes is conditional upon the provision of cheap power, and as the processes are as yet undeveloped they cannot be so important a factor as to influence to any marked extent the conditions immediately following upon the cessation of hostilities. On the other hand, the introduction of synthetic methods for the production of nitric acid, which are now in early stages of operation, tends to diminish the consumption of sulphuric acid for the manufacture of nitric acid.

The Committee have found that the immediate increase in the consumption of acid after the war is almost wholly a question of the development of the superphosphate industry. They have accordingly considered evidence both from agricultural experts and from fertiliser manufacturers as to the probable post-war position. It is evident from the opinion of these witnesses, quite apart from any question of manufacturing facilities, that the greatly extended use of phosphatic manures is both economically profitable

and essential for the efficient cultivation of the land. The extent to which such extended use will in fact take place depends mainly upon the agricultural policy of the Government. Prof. T. H. MIDDLETON, Deputy Director General of the Food Production Department, submitted to the Committee an estimate of the post-war increase of fertilisers based on the assumption that 3 600 000 acres of arable land would be added to the existing area in the United Kingdom and that a larger proportion of the grass land would be manured. This estimate further indicated that an additional quantity of 620 000 tons of superphosphate and 629 000 tons of basic slag could with advantage be used. This increased quantity of superphosphate would correspond to the absorption of 200 000 tons of sulphuric acid.

The available supply of basic slag is not likely to approach the figure mentioned above, but as this phosphatic manure can to a considerable extent be replaced by superphosphate, it is evident that a much larger quantity of superphosphate could be employed if it were available.

It has been difficult to obtain any exact data regarding the question of the future export market for superphosphate. The export trade has declined, and fertiliser manufacturers themselves do not appear to anticipate any considerable revival. It would, therefore, be unwise to count upon the export trade as a means of permanently reducing the surplus of sulphuric acid to any extent, although in the years immediately succeeding the war Belgium may be a large buyer.

In view of the proved agricultural need for greater quantities of fertilisers, the Committee are of opinion that the large surplus of sulphuric acid plant which will become available at the end of the war provides an opportunity of an altogether exceptional nature for the development of a vigorous agricultural policy in relation to the efficient cultivation of the soil. Having regard, therefore, for the guarantees which are given to the farmer under the Corn Production Act, the Committee recommend that the powers provided by Section 9 of the Act should be widely used to enforce the adequate use of fertilisers.

In conclusion, the following recommendations are made for providing an outlet for the surplus sulphuric acid which may be expected over the pre-war production as regards the production of fertilisers:—

a) That in the exercise of any compulsory powers given by the Corn Production Act every possible step should be taken to extend the use of fertilisers.

b) That in every way — by lectures, by practical demonstrations, and by experiments carried out at Government expense on plots easily accessible in various parts of the country — farmers should be encouraged and educated in the increased use of fertilisers.

c) That arrangements should be made with shipping, railway, and canal companies for cheap and adequate transport of raw materials, acid, and fertilisers, and that cheap freights should be arranged for the carriage of fertilisers to any part of the Empire or any Allied or neutral country where an opening for a market may offer.

741 - Some Availability Studies with Ammonium Phosphate and its Chemical and Biological Effects upon the Soil (1). — ALLISON, F. E., in *Soil Science*, Vol. V, No. 1, pp. 1-79 + 10 Figs. + Bibliography of 36 publications. Baltimore, January, 1918.

The investigations were carried out with "Ammono-Phos", an ammonium phosphate fertiliser prepared by the American Cyanamide Company. It consists of ground mineral phosphate mixed with sufficient sulphuric acid to free all the phosphoric acid, which is removed by filtration and washing. Gaseous ammonia is produced by steaming crude calcium cyanamide in an autoclave under a pressure of several atmospheres; the ammonia is bubbled into the phosphoric acid until it is converted chiefly into di-ammonium phosphate, though at the same time some citrate-insoluble iron and aluminium ammonium phosphates are formed. Phosphoric acid is then added, using methyl orange as an indicator, till the proportion of mono-ammonium phosphate is attained which will make the insoluble phosphates assimilable. When evaporated to dryness the solution gives a commercial product, "Ammono-Phos", a light grey material resembling superphosphate.

Up to the present nearly all the investigations on the use of ammonium salts as fertilisers have been made with ammonium sulphate or other salts, but never with ammonium phosphate on account of its high price. Now that a satisfactory method has been found for producing it commercially it is important to determine the conditions under which this fertiliser gives the best results and the quantities in which it may be applied safely and economically to various crops.

According to the author's tests commercial ammonium phosphate fertiliser contains about 13.5 % ammonia and 43 % phosphoric acid, 96.5 % of which is soluble in water and citrate. The nitrification of ammonium phosphate is similar to that of ammonium sulphate, but the ammonification differs. Soil fungi utilise the various nitrogenous compounds tested in the following decreasing order: — ammonium phosphate, ammonium carbonate, ammonium sulphate, urea, ammonium nitrate, sodium nitrate.

On an average the nitrogen recovered from a sandy soil after six harvests (one of barley, four of buckwheat and one of maize) was: 65.88 % for ammonium phosphate, 61.10 % for ammonium sulphate, 43.74 % for dried blood, and 41.19 % for cottonseed meal. In a loam soil the recovery was respectively: — 48.46 %, 50.42 %, 42.51 %, and 36.49 %. Liming increased the nitrogen recovery and the crop yield was in relation to this ratio except under very acid conditions, when ammonium sulphate gave a higher nitrogen recovery than phosphate, but a much smaller crop. The author believes the relatively low nitrogen recovery is due to the loss of free nitrogen or ammonia through the soil as well as through the plants. The increased lime requirement per acre resulting from the respective applications was: — for ammonium sulphate 794 lb., ammonium phosphate 525 lb., dried blood 263 lb., and cottonseed meal 113 lb.

Pot experiments showed an almost equal utilisation of nitrogen for commercial ammonium phosphate, its aqueous extract and sodium nitrate.

(1) See *R.*, 1916, No. 272. (Ed.)



Only the water insoluble ammonium phosphate gave a slightly lower yield than the other forms of nitrogen. Greenhouse experiments did not, on an average, show great differences in the availability of the phosphorus of the ammonium phosphate, superphosphate or basic slag. In very acid soils superphosphate was sometimes superior to ammonium phosphate as a source of phosphorus because it does not appreciably increase the acidity which ammonium phosphate does increase.

Germination experiments showed that, with equal quantities of nitrogen, ammonium phosphate has a toxicity equal to that of ammonium sulphate, but inferior to that of sodium nitrate and ammonium chloride, when applied in high concentrations. In very sandy soils toxicity is obtained with  $\frac{1}{10}$  the amount of fertiliser required in clay or silt soils. The toxic action of commercial ammonium phosphate does not exceed that of pure mono-ammonium phosphate. As regards the action of the various nitrogenous and phosphoric fertilisers on germination, lining decreased the growth of maize when the fertiliser was applied in small quantities, and increased the growth when large quantities of fertiliser were used. As a rule mixing fertilisers did not lessen the toxic effect. Maize, buckwheat, barley, wheat and oats resist heavy applications of fertiliser, but vetch, rape, and cowpea are relatively susceptible.

Under laboratory conditions the effect of fertilisers applied to 200 gm. of soil in glasses, was the same whether they were uniformly mixed with the soil or placed in direct contact with the seed. Under field conditions applications of 100 lb. of ammonium phosphate per acre in rows did not harm maize, but applications of 150 lb. proved slightly injurious.

In conclusion it may be said that ammonium phosphate has as a rule the same nitrogen value as ammonium sulphate and the same phosphorus value as superphosphate, and might be used to replace these two fertilisers. The few exceptions, under abnormal conditions, do not alter this conclusion, all the more so because ammonium phosphate is rapidly nitrified and utilised by micro-organisms and plants. The fertiliser resembles ammonium sulphate in its toxic effects when applied in high concentrations, and is slightly less toxic than sodium nitrate. As with other soluble fertilisers care must be exercised in the amount used when it is applied in drills.

742 - **The Identification of Grasses by their Vegetative Characters.** — CARRIER, LYMAN, (Agronomist in Pasture Investigations), in *U. S. Department of Agriculture, Bulletin No. 461*, pp. 30 + 60 Figs. Washington, January 19, 1917.

An attempt is made to identify grasses by the vegetative characters of their structure and of some special organs of the root, stem, and leaf, so that the inflorescence is not required for this purpose. Many attempts have been made previously to do this, especially by McALPINE, WARD, STEBLER and SCHRÖTER, and PERCIVAL. The author follows in part Percival's method, and gives a dichotomous table of 56 species which are classified and illustrated in the bulletin.

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743 - **Composition of Citrus Leaves at Various Stages of Mottling** (1). — JENSEN, C. A. (Assistant in Plant Malnutrition, Office of Biophysical Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.), in the *Journal of Agricultural Research*, Vol. IX, No. 6, pp. 157-166 Bibliography of 11 Publications. Washington, D. C., May 7, 1917.

Previous studies of the soil factors influencing the mottling of Citrus leaves in southern California have shown that the percentage of mottling of the Citrus leaves varies inversely with the humus content of soils in Citrus groves; that decomposing organic matter increases the amounts of soluble salts in the soil; and that a system of basin mulching in Citrus groves, especially on certain soil types, has produced an improvement in tree growth and fruit setting in comparison with the furrow system of irrigation and surface cultivation.

The purpose of the study here reported was to see if mottled Citrus leaves showed a deficiency of the mineral elements directly affecting chlorophyll formation.

It was found that very badly mottled orange and lemon leaves contained higher percentages of iron, calcium, magnesium, and phosphoric acid than healthy leaves, the average percentage of the entire leaf being considered. The leaves in the medium stages of mottling sometimes contained more and sometimes less of these elements than healthy leaves.

In nearly all cases the midribs of the healthy leaves contained less of the above mentioned elements than the mesophyll tissue. In badly mottled leaves the midribs contained a higher percentage of calcium than the mesophyll tissue, usually as much magnesium, and usually more phosphoric acid.

With very few minor exceptions, the leaf stems contained less iron, calcium, and magnesium than either the midrib or mesophyll area in both healthy and mottled leaves. The percentages of calcium, magnesium, and phosphoric acid, however, increased in the leaf stems of badly mottled Citrus leaves, but usually not in the medium mottled leaves.

Old leaves contained higher percentages of calcium and magnesium than new leaves not fully grown.

In all the Citrus leaves analyzed, the phosphoric acid was quite uniformly distributed in the midribs, the mesophyll tissue and the leaf stems (regardless of age or stage of mottling), indicating that phosphoric acid is early and freely transferred through the conducting tissue to the mesophyll areas. Sharply outlined yellow spots in the mesophyll areas of orange leaves contained less calcium, magnesium, and phosphoric acid than the green parts (mostly veins) of the leaves.

Judged by a comparison of the average percentages of the inorganic elements determined in healthy Citrus leaves and in leaves in the medium stages of mottling, the data obtained did not show that the initial mottling could be accounted for by deficiency in the transfer of the iron, calcium, magnesium, and phosphoric acid from the conducting system of the leaf stem and midrib to the mesophyll tissue. On the other hand, sharply localized yellow areas in old orange leaves contained less of these elements than the

(1) See also R. February 1918, No. 173. (Ed.)

adjoining green areas (mostly veins), but whether that relation obtained in the initial stage of mottling was not determined. In very badly mottled Citrus leaves there was in general an increase in the percentage of these elements in the conducting tissues, including the leaf stems, indicating difficulty in their transfer to the mesophyll tissues in very advanced stages of mottling, probably because the leaf had become functionless.

Green leaves and the green parts of spotted leaves of the golden privet (*Ligustrum aurea*) contained about twice as much calcium and appreciably more magnesium than the yellow leaves. Yellow leaves and the yellow parts of spotted leaves contained more iron than and about 2.5 times as much phosphoric acid as the green leaves or green parts of spotted leaves. Leaf stems of green privet leaves contained lower percentages of iron, calcium, magnesium, and phosphoric acid than the leaves. Leaf stems of yellow privet leaves contained about one-half as much phosphoric acid as the leaves; the percentages of iron and magnesium were about the same, while the leaf stems contained more calcium than the leaves. The leaf stems of yellow privet leaves contained higher percentages of calcium and magnesium than the leaf stems of green privet leaves.

- 744 - **The Fats and Fatty Acids of the Grain Sorghums.** — FRANCIS, C. K. and FRIEDMANN, W. G., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Oklahoma, Bulletin No. 117*, 11 pp., 1 fig., 5 Tables. Stillwater, Okl., October, 1917.

Six fatty acids have been shown to be present in kafir, feterita and milo fat, namely: oleic and linoleic, stearic and palmitic, butyric and formic, predominating in the order given. Traces of saturated acids higher than stearic acid are present in kafir and milo fat. The tables given by the authors show that the physical and chemical constants of the fats and fatty acids of kafir, feterita and milo are similar. The percentages of fat obtained by the extraction method were as follows: feterita 2.72-2.80; milo 2.53-2.61; kafir 0.89.

- 745 - **The Chymase of *Solanum elaeagnifolium*.** — BODANSKY, A. (Department of Physiology and Biochemistry, Cornell University, Ithaca), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 103-105. Baltimore, Md., 1916.

In New Mexico and Arizona the berries of *Solanum elaeagnifolium* are used as a substitute for rennet in the coagulation of milk. By means of maceration and precipitation with acetone the writer has extracted from the mature berries a chymase which possess the following properties:— It coagulates boiled natural milk without addition of calcium chloride. It proved more resistant to heat than animal rennin. In tests conducted between 37 and 55° C. the time of coagulation was inversely proportional to the quantity of the enzyme, other conditions being constant. Increase of temperature had the effect of increasing the rapidity of coagulation, but it also inactivated the enzyme. The optimum temperature was 84° C., in a dilution of one part of the solid enzyme preparation to 20 000 parts of milk, coagulation taking place in about 1 minute. In a dilution of 1:100 000 coagulation occurred in 10 minutes the enzyme being obviously inactivated.

germination advanced. It fluctuated in the cotyledon somewhat parallel to amide nitrogen, but in the shoot it decreased while amide nitrogen increased.

Amides accumulated in the shoot throughout all the different stages of germination, but not in such large proportions as previous investigators have reported. This may be due to the faulty methods of analysis formerly employed. In the cotyledon the amide nitrogen fluctuated somewhat at early stages, but later increased remarkably, while  $\alpha$ -amino-acids were disappearing rapidly.

Amides accumulated while carbohydrates and ammonia decreased. It may be inferred that they were produced synthetically from the latter compounds. The evidence for such a view from this study, however, is insufficient to be conclusive.

$\alpha$  amino-acids accumulated rapidly, especially in the cotyledon during the earlier stages of growth. In the later stages of growth they decreased considerably in the shoot and disappeared rapidly and completely from the cotyledon.

The accumulation of amides simultaneously with the decrease of  $\alpha$ -amino-acids and ammonia in the shoot indicates that  $\alpha$ -amino-acids serve for amide production in the nitrogen metabolism of the etiolated pea plant.

**748 - The Effect of One Plant on Another.** — PICKERING, SPENCER, in *Annals of Botany*, Vol. XXXI No 122, pp. 181-187 + 3 Figs. London, April, 1917.

As a result of numerous investigations started in 1895 the author noted the injurious effect which one plant may have on another. In a series of pot experiments he found the following species to be subject to such influence: — apple, pear, cherry, plum, six kinds of forest trees, mustard, tobacco, tomatoes, barley, clover and two varieties of grasses. The plants exercising the injurious effect were apple seedlings, mustard, tobacco, tomato, two varieties of clover and sixteen varieties of grasses.

Some plants can exercise this action on other individuals of their own species; this is the case with tobacco, tomato, mustard and apple. This may be compared with the well-known phenomenon of the bad development of a young plant near an older one. The author believes that the roots of the plant exercising the injurious influence secrete a toxic substance. Recent experiments confirmed this theory. He made three pot experiments with mustard. On the surface of the first pot was placed a tray containing soil, and so perforated that the water percolated through to the pot below. In this case growth was normal and there was no injurious effect. In the second test a crop of mustard was grown in the tray, but the holes were stopped and the water for the plants in the pot below was given to them direct. Growth was also normal in this case. The conditions in the third test were similar to those of the second, except that the holes were left open and the water for the plants below only reached them after having passed through the tray. In this test the growth of the mustard in the large pot was reduced to  $\frac{1}{100}$  of the normal growth.

The extent of this action varies greatly ; in pot experiments reduction in growth varies from 6 to 97 % ; in field experiments with trees it may be very small or sufficient to kill the plant.

Attempts have been made to explain this phenomenon by many hypotheses, such as rapid exhaustion of the soil, etc., but they have all been rejected. The toxic substance which appears to cause the action oxidises rapidly ; water containing it loses its toxic properties when exposed to the air for 24 hours.

749 - **Selection of Wheat in Ontario, Canada.** — ZAVITZ, C. A., in the *Ontario Department of Agriculture, Agricultural College, Bulletin 261*, pp. 30 + 4 Figs. Toronto (Ontario), February, 1918.

PLANT  
BREEDING

WINTER WHEAT — 1) The mass selection method is still followed by the Canadian Seed Growers' Association and by some experiment stations. Seed obtained in the third year after three successive selections is sold as a guaranteed selected product.

2) An excellent example of the results of individual selection is shown by the winter wheat Dawson's Golden Chaff derived from a plant isolated in 1881 near Paris, Ontario. This plant, remarkable in the midst of lodged wheat on account of the strength and elasticity of its straw, which prevented its lodging, transmitted its character to its descendants, which now form one of the favourite wheat varieties. By individual selection of the variety Imperial Amber a pure line was obtained with a yield exceeding that of the parent variety by 3.9 bushels per acre.

3) The hybrids Dawson's × Tasmania Red, Dawson's × Bulgarian and Dawson's × Turkey Red gave in all cases an average grain yield superior to that of the parent plants.

The cross Dawson's × Bulgarian gave a new variety, O. A. C. No. 104, which, during 6 years, gave an average of 45.0 bushels per acre, *i. e.*, 4.2 bushels more than Dawson's and 7.5 bushels more than Bulgarian. Not only did O. A. C. exceed the yield of both its parent plants, but it also exceeded the other varieties more widely grown in Ontario — Imperial Amber, Kharkov and Yaroslaf. The new variety is beardless, like Dawson's and has white glumes, like Bulgarian.

In addition to these selection experiments numerous tests were made on yield, resistance to rust and lodging, with the following results : —

The average grain yields for 5 years were : — Imperial Amber, 45.8 bushels per acre ; Kharkov, 45.7 bushels ; Gillespie Red, 45.2 bushels ; McBean's Golden Chaff, 45.1 bushels ; Tuscan Island, 44.9 bushels ; Grand Prize, 44.7 bushels ; American Banner, 44.6 bushels. These are the varieties best suited to the district. Theiss, Kharkov, Tuscan Island, Yaroslaf and Banatka were freest from rust ; Tystofte Smaa and McBean's Golden Chaff were both badly attacked. Dawson's Golden Chaff, American Banner, Imperial Amber, Michigan Amber, McPherson and Scott were the earliest varieties. The varieties with the weakest straw and, consequently, most subject to lodging, were Banatka, Theiss, Crimean Red, Geneva and Kharkov.

SPRING WHEAT. — 1) A new hybrid obtained by crossing the Red Fife

and Herison Bearded varieties gave, on a five year average, a yield (40.7 bushels per acre) superior to any of the spring varieties tested in Ontario.

The results are given of numerous selection experiments with spring and winter wheat and rye, all of which confirm the influence of selection of the largest and heaviest seed on the crop.

**750 - Increased Self-Fertilisation of Petkuser Rye by Pure Line Selection, in the Netherlands.** — MEYER, GMELIN H., in *Cultura*, Year XXX, No. 353, pp. 14-19. Wageningen, 1918.

In 1915 the author sorted out 56 ears of Petkuser rye in order to determine whether distinct and improved types could be isolated by pure line selection. The results are of special interest with regard to the self-fertilisation of rye (1).

In 1916 the plants of each strain were divided into three groups:— 1) plants freely exposed to cross-pollinisation; 2) plants the inflorescences of which were partially isolated with muslin, the web being coarse enough to let pass a certain amount of pollen carried by the wind; 3) plants the inflorescences of which were completely isolated with parchment.

In 1917 the ears of a certain number of descendants of each of these three groups were completely isolated before flowering by bags of parchment. The plants thus subjected to forced self-fertilisation showed marked differences in the percentage of setting. Some, as those of line 3, had as much as 57 seeds per ear, whereas others did not produce as much as a single seed. Line 3 was remarkable for its high degree of self-fertilisation, with an average of about 20 seeds per ear. It is, therefore, possible by pure line selection to isolate types of rye with a degree of self-fertility much above the normal.

The author intends to continue this selection work taking into consideration the shape and colour of the ear. The original number of strains has been gradually reduced to three — Nos. 28, 37 and 3 — by successive elimination of the worthless ones. Line 28 has an ear with square section of the real Petkuser type. Line 37 is characterised by a special colour of the unripe ear and by a tendency to produce three seeds per spikelet, which makes it very broad and compact. As has been already said, line 3 ranks first in self-fertilisation.

**751 - Selection Experiments with Two Cultivated Oats According to the Position of the Seed in the Spikelet, in France.** — DANTEL, L. and MIRGE, E., in *Annales des sciences naturelles*, Vol. XX, Nos. 1-6, pp. 289-308 + 11 Tables + 6 Figs. Paris, 1917.

The spikelets of oats are composed of a variable number of alternate flowers which may be arranged as follows:—

1) Two fertile flowers, internal and external, and a much larger and more membranous sterile flower;

2) Three fertile flowers, one of which, known as "intermediary", is between the external and internal flowers;

(1) The degree of self-fertilisation of rye is very low; the percentage of setting in self-fertilised plants rarely exceeds 5 %. See R. Feb., 1918, No. 146. (Ed.).

3) A single fertile flower called "single" flower, and one rudimentary sterile flower; the former represents the external flower of the preceding cases.

Four very different kinds of seed correspond to the various flowers:—*a*) external; *b*) single; *c*) intermediary; *d*) internal. The size, morphological peculiarities and proportion of these seeds serve to differentiate the principal varieties of cultivated oats. It is generally admitted that the external seeds are heavier than the internal ones, but the kernel is not so plump. As regards weight and construction single seeds closely resemble external seeds, intermediary seeds internal ones.

This has been shown by the work of various authors (chiefly DENAÏFFE & SIRODOT, DUFOUR), but up to the present no investigation appears to have been made into the agricultural value of these different seeds and the possibility of a selection based on their separation, and the advantages to be derived therefrom. Nevertheless, the very position of these different seeds on the inflorescence and their respective development seems to show that there exists between them, in addition to their morphological differences, physiological differences capable of being transmitted to their descendants.

In order to solve this question the authors undertook from 1910 to 1913 a set of experiments the results of which they now give.

In the first place, from a commercial lot of the two varieties, Canadian white oats and Brie black oats, 1 000 seeds were chosen at random, and divided into the four above mentioned groups to determine the proportion. A predominance of intermediary seeds was found in the white oats, and of external ones in the black oats.

An equal number (300) of the seeds of each group and the original mixture was sown in separate plots in order to determine the yield and characters of the descendants. The yields of the four groups (I-IV) and the original mixture (V) were:—

*White oats.* — I) 245 gm.; II) 195 gm.; III) 175 gm.; IV) 215 gm.; V) 210 gm.

*Black oats.* — I) 135 gm.; II) 250 gm.; III) 160 gm.; IV) 130 gm.; V) 180 gm.

In white oats, therefore, the external seed gave the highest yields, in black oats the single seeds. This shows that the position of the seed on the spikelet does not influence the yield.

It was of interest to know whether the descendants of the external seeds of white oats and the single seeds of black oats were respectively richer in external seeds and single seeds, and, consequently more productive than the parent variety. To test this the descendants of each of the above groups of seed were sorted in 1911 with the following results:— in white oats the *single* seed predominated in the descendants of each group, being most numerous in those of the *internal* seeds. In black oats, on the contrary, the *external* seeds predominated, reaching their maximum in the descendants of the *intermediary* seeds. Thus, in spite of selection, the same type of seed (single in white oats, external in black oats) was

predominant in all the groups. Moreover, selection did not accentuate or even preserve, the character which it should have perpetuated, for the number of seeds in each category was about the same from whatever kind of seed it was derived.

The inefficiency of the selection was also clear when the composition of the descendants of the sorted and mixed seeds was compared. The differences were very small, practically negligible, and all the seed, whether sorted or not, may be said to have given the same result.

Determinations were also made for each group of the weight of 100 seeds and the relative proportion, in weights, of the coat and kernel. It was found that these factors depend neither on heredity nor selection, but vary according to the varieties and environmental conditions (climate, etc.).

CONCLUSIONS. — 1) The proportion of the different seeds, as characterised by their position on the spikelet, is not hereditary but subject to environmental conditions the influence of which is manifest in a different way according to the variety under consideration.

2) The weight of the different seeds is very variable.

3) Selection based on the separation of these different seeds is of slight value as regards their distribution among the descendants, their weight, or the relative proportion of coat and kernel.

4) The different seeds are of unequal value as regards yield and the quality of the product, but these values are not characteristic of the seed and vary with the variety and climatic conditions.

5) The 1913 experiments gave results differing slightly from those of the preceding years; they showed the actual and general predominance of two-seeded spikelets, but this predominance, present in all the groups whatever their origin, cannot be attributed to selection.

6) Finally, if the position of oat seeds on the spikelet gives them certain morphological peculiarities (known for a long time and enabling them to be easily distinguished), it gives them no physiological property or special hereditary quality so that it does not make efficient selection possible.

752 — **The Inheritance of Characters in Rice, in India.** — PARNELL, F. R., RANGASWAMI AYYANGAR, G. N., and RAMIAH, K., in *Memoirs of the Department of Agriculture in India, Botanical Series*, Vol. IX, No. 2, pp. 75-105 + 21 Tables + 5 Coloured Plates. Calcutta, November, 1917.

The experiments described were started at the Government Farm of Coimbatore in 1913 with about 100 varieties of rice.

SIZE OF OUTER GLUMES. — The rice spikelet is single-flowered, with two outer sterile glumes, 1 inner fertile glume, and a palea; these two last are joined and referred to together as inner glumes. The outer glumes are small, rarely more than  $\frac{1}{4}$  to  $\frac{1}{5}$  the length of the inner glumes, except in the Rakki Pakshi Bhatta variety in which both kinds of glume are about the same length.

In a plot of rice with short outer glumes which had been exposed to cross-fertilisation, were found several varieties with long outer glumes. Eight of these were selected and all their descendants were long glumed. On the other hand some of the short-glumed varieties transmitted this



character without change, whereas others had mixed descendants including short-glumed and long-glumed plants in the Mendelian ratio of 3 : 1, thus showing the short-glumed character to be dominant to the long-glumed.

**GOLDEN COLOUR OF INNER GLUMES AND INTERNODES.** — The colour is usually light green, but in many cases it is gold, and when such this character is recessive to green, the ratio of green-glumed to gold-glumed plants in  $F_2$  being 3 : 1. In other cases transmission of colour is so complicated as to suggest the presence either of another determinant for the gold which is incompletely dominant to green, or of an inhibitory factor acting only on the glumes, the internodes remaining golden.

**FACTOR CONCERNED IN THE DISTRIBUTION OF COLOUR IN THE GLUMES.** — The inner glumes are often of a characteristic blackish-brown colour which affects the furrows more particularly. As the golden colour, the blackish-brown may be subjected to a factor which localises it in the centre of the glume, the top and base of which remain entirely green. This factor is dominant; in  $F_2$  the respective numbers of plants with piebald glumes and those with glumes of uniform gold or with blackish-brown furrows down their whole length, are in the Mendelian ratio of 3 : 1.

**PURPLE PIGMENTATION.** — This is due to the presence of anthocyanin in the cell sap. The character "pigmented" is dominant to the character "unpigmented". Between the pigmented and unpigmented individuals there are the two ratios 3 : 1 and 9 : 7, which suggests the presence of two distinct factors of pigmentation. This hypothesis was confirmed by the results of an experiment in which purple pigmented plants were obtained from a cross between the unpigmented Garudan Samba variety with an  $F_3$  hybrid, also unpigmented. The two purple factors were evidently distributed in a heterozygous state in the two parents.

**DARK PURPLE COLOURING OF THE PULVINUS AND AURICLE.** — In the absence of the factor causing this colour the *pulvinus* (swollen zone at the base of the leaf-sheath immediately above the node) and the auricle remain green or greenish-white. In this case the pigmented character is also dominant.

Similar conditions also govern the purple pigmentation of the leaf-sheath; this pigmentation often extends to the ligule.

**PURPLE LINING OF INTERNODE (L), PURPLE GLUMES (G), PURPLE STIGMA (S), PURPLE AXIL (A).** — To study these characters, the determinants of which are expressed by the letters in parenthesis, a cross was made between two plants of the Basangi variety, one of which had purple lining of the internode, purple glumes and no pigmentation of the stigma or axil (LLGGssaa), the other purple stigma and axil but no pigment in the other organs (llggSSAA).  $F_1$  gave a hybrid with the formula LlGgSsAa.

In  $F_2$  it was found that each character, considered separately, is dominant to the character "unpigmented". Considered together, however, these characters showed that:— 1) purple lining is associated with purple glumes (L and G in conjunction); 2) purple stigma is associated with purple axil (S and A in conjunction); 3) green internodes and glumes are associated with purple stigma and axil. In  $F_2$  there are, then, only three

distinct types:— **LGsa**, **LGSA**, **lgSA**, present in the ratio 1 : 2 : 1; thus **L** is coupled with **G**, **S** with **A** and **LG** repels **SA**.

The  $F_1$  hybrid with the formula **LlgGssAa** thus only forms two types of gamete: **LGsa** and **lgSA** which combine in  $F_2$  to form 1 **LLGGssaa**, 2 **LlgGssAa**, 1 **llggSSAA**, i. e., two pure types resembling the parents and 1 type resembling the  $F_1$  hybrid.

The two factors **S** and **A** are constantly coupled and the authors never found any exception to this rule. **L** and **G**, however, sometimes show aberrant types thus proving the connection between them to be less strong than that between **S** and **A**. Cases of repulsion were observed not only between the two groups **LG** and **SA**, but also between **LG** and **S**, **G** and **S**, **L** and **S**.

**RIPENING BLACK CHARACTER OF INNER GLUMES.** — In certain varieties of rice, when the grain begins to ripen the glumes turn almost entirely black, becoming paler later so that, when ripe, they are of a dull smoky colour. The black character is dominant to the straw-coloured character and evidently depends on two factors. This was shown by an examination of  $F_2$ , in which the number of plants with black glumes and yellow glumes respectively were in the ratio of 3 : 1 or 9 : 7, according to whether the parent is heterozygous for one or both of these factors.

**COLOUR OF THE GRAIN.** — The colour of husked rice varies, from white through a series of intermediate shades, to red.

By crossing the Sadai Samba (white) and Boru Muruthagna Bhatta (red) varieties, were obtained, in  $F_2$ , red-grained and white-grained individuals in the ratio of 3 : 1. Red therefore is dominant to white.

In certain cases, however, the segregation of these characters is more complicated.

Two natural red varieties gave, in  $F_2$ , three definite groups, — a) full-red grain, b) grey-brown grain and c) white grain, in the ratio 9 (red) : 7 (grey-brown × white) as if the red were due to the simultaneous presence of two factors one of which by itself produces the grey-brown type. On the other hand, further investigation including  $F_3$  and  $F_4$  tends to show that full red is due to one single determinant, which produces red in the presence of the purple pigmentation factor, and grey-brown in its absence.

**Improving Alfalfa by Selection and Hybridisation in Manitoba, Canada.** — Southworth, W., in *The Agricultural Gazette of Canada*, Vol. V, No. 2, pp. 158-162 + 2 Figs. Ottawa, February, 1918.

The experiments described have been carried out since 1915 at the Manitoba Agricultural College with the aim of producing types of alfalfa suitable for forage and seed, and, at the same time, resistant to the low temperatures of the Canadian winter.

**PURE STRAIN SELECTION.** — At present the plants being tested number 4,000 and belong to 8 different strains, one of which seems to unite in good proportions a high forage yield and high seed yield.

**HYBRIDISATION.** By crossing common alfalfa (*Medicago sativa*) with the yellow-flowered type (*Medicago falcata*) known for its resistance to

low temperatures, 31 plants were obtained in the  $F_1$  which are remarkable for their strength and vigour.

It is hoped to isolate types valuable both for their yield in forage and resistance to cold.

754 - Sugar Beet Seed Production and Stock of the United States. — I. Beet Seed Crop of 1917 Larger; Acreage Smaller, in *Facts About Sugars*, Vol. VI, No. 2, pp. 27. New York, 1918. — II. Beet Seed Report Issued. *Ibid.*, No. 13, pp. 253. — III. Country Has Ample Beet Seed Supply for Season; *Ibid.*, No. 15, pp. 287. (1).

AGRICULTURAL  
SEEDS

The sugar beet seed production of the United States during the year 1917 is reported by the Department of Agriculture at 5 546 000 lb., an increase of 335 000 lb. or rather more than 6 per cent over the crop of 1916. While the seed production was larger, the acreage devoted to cultivation of seed beets was 13 per cent less than in 1916, the crop of 1917 being grown on 4 579 acres, as compared with 5 268 acres devoted to seed beets in the preceding year.

The far western States of California, Idaho and Utah were responsible for the increase in production in 1917, the other seed producing areas showing a decrease. In these three states the crop last year was 2 458 000 as against 1 628 000 lb. in 1916, a gain of 51 per cent. The acreage devoted to seed production in these States was 2 523, as compared with 2 178 in the year before, an increase of 15 per cent.

In the other great seed producing area, embracing the states of Colorado, Kansas, Nebraska and Montana, the seed crop of 1917 was 12  $\frac{1}{2}$  per cent. smaller in 1917 than in 1916, the figures being 3 030 000 lb. for last year and 3 445 000 lb. for the year before. In 1916 this territory produced 66 per cent. of the country's total seed crop while last year its production was only 54.5 per cent. of the total. The acreage devoted to seed beets decreased in this territory from 2 725 acres in 1916 to 1 978 acres in 1917, a decrease of nearly 28 per cent.

CREAT  
AND BULL  
CROPS

Beet seed production in Michigan and Ohio in 1917 was only 58 000 lb., as compared with 128 000 lb. in 1916, a falling off of more than half. The area in seed beets in these states decreased from 365 acres in 1916 to only 78 acres last year.

In point of production per acre the Colorado-Kansas-Nebraska-Montana territory made the best showing, obtaining an average of 1 532 lb. of seed to the acre, as against an average of 974 lb. to the acre for California, Idaho and Utah and an average of 744 lb. to the acre for Michigan and Ohio. The Great Western Sugar Company, the Utah-Idaho Sugar Company and the United States Beet Seed Company were the country's largest producers.

According to the final figures on sugar beet seed stocks in the United States on January 31, 1918, as collected by the War Emergency Seed Survey, there were on hand 19,249,371 lb. of imported beet seed, and 7,947,614 lb. of home grown seed, a total of 27,196,985 lb. (1)

As compared with the corresponding date of 1917, the report shows an increase of 3,740,918 lb. in the stock of imported and 2,495,443 lb. in the

(1) See R. 1917, No. 139, (E4).

stock of domestic seed, making a combined increase of 6 236 361 lb. or nearly 30 per cent., during the year. Importation of sugar beet seed into the United States during the twelve months' intervals, as reported by the Department of Commerce, amounted to 15 437 797 lb.

Checking up these figures for stocks on hand at the two dates and of receipts in the interim, it appears that the domestic sugar beet crop of 1917 required in the planting a total of 14 747 436 lb. of seed. The beet acreage for 1917 is estimated by the Department of Agriculture, at 675 400 acres, which works out at an allowance of 21.8 lb. of seed to the acre. This, however, takes no account of replantings nor of acreage planted which yielded no crop.

As regards seed supplies for the coming season and for that to follow it is apparent that there is sufficient seed on hand to plant a normal beet acreage for 1918, including the necessary replantings, and that after the planting season is over there should be a surplus of from 20 to 25 per cent. of the sugar beet seed requirements for 1919. Very little sugar beet seed has been imported since January 31, 1918, and it is not probable that any large quantity will be imported before the close of the 1918 planting season.

In view of the small surplus that will remain after the 1918 planting has been finished, it is evident that a considerable increase in domestic seed production, together with a large importation of seed, will be necessary in order to make possible a normal sugar beet acreage in 1919. Reports indicate that the beet sugar companies are awake to the situation and are preparing to increase their seed production this year.

**CEREAL  
AND PULSE  
CROPS**

**755 — The Best Varieties of Italian Rice.** — NOVELLI, N., in the *Giornale di Agricoltura della Domenica*, Year XXVIII, No. 17, p. 89 + 4 Figs. Piacenza, April 28, 1918.

The great number of varieties of Italian rice is a disadvantage which the "R. Stazione sperimentale agraria di risicoltura" of Vercelli is trying to overcome by selection, organisation of the production of selected seed, and the supply of such seed to growers. This would allow the cultivation of a limited number of the best varieties of rice.

The most productive varieties are known as "common", whereas the "semi-fine" or "fine" ones are earlier and more appreciated for the quality of their produce. At the present time, when a large production is essential, the author advises that the following varieties be sown: — "Chinese originario" or "Abbondanza"; "Onsen", now acclimatised and grown in North Italy on account of its very high yield and relative earliness; some of the good early types derived from "Chinese originario" (1) more suited to cold, shady soils and late sowing; these rices do not suffer from lack of nitrogenous fertilisers because they have little herbaceous growth and much seed — 60 % or more of paddy and 40 % or less of straw; "Lencino", which in suitable soils gives very high yields and does not drop its grain, even when ripe; "Ranghino" (2); "black" and "yellow Vialone". As varieties for transplanting "Chinese originario" and "Onsen" are especially recommended because they tiller rapidly and give a maximum crop. Where

(1) See R. 1917, No. 330. — (2) See R. 1916, No. 34. (Ed.)

it is necessary to increase the acreage under cereals at the expense of fields already fertilised and prepared for forage, it is advisable to make the first and most important cut of hay, then to transplant the rice, which in the meantime, has been grown in seed-beds.

To encourage the transplanting of rice the Ministry of Agriculture offers rewards of 30 to 50 lire per hectare (about 10s. to 16s. pr acre), to be divided between the most skilled growers and labourers.

**756 - "Early Dellarole" Rice.** — MARCARELLI, B., in *Il Giornale di Riscoltura*, Year VIII, No. 3, pp. 35-38 + 1 Fig. Vercelli, March 31, 1918.

This variety was isolated in 1911 from a rice from China by Signor NICOLAS DELLAROLE of Vinzaglio (province of Novara) who tested it under the most varied conditions. Having convinced himself of the constancy and uniformity of the descendants, he distributed it for cultivation on a large scale. It is now used not only in the districts bordering on that from which it originated, but also wherever it has been tested.

The principal characters of this new rice are :— easy adaptation to the most-varied soils, perfect grain from a commercial point of view, marked earliness. As it ripens in 120 to 130 days from the date of sowing, it is much to be recommended for old rice fields with cold damp soil so long as the irrigation water is warm. It also does well in new fields, converted from meadows, so long as nitrogenous fertilisers are not used excessively, as in this case it lodges. The author describes it as follows :— erect, little inferior in vigour to "Chinese originario"; culm relatively thin, not very resistant to lodging, arched at the cyme with white nodes, leaves removed from the culm, short and light green till earing, panicles rather close and arched, of average length and breadth, with long spikelets at their base; caryopses few, longer than those of "Chinese originario", of a fine straw colour when ripe; glumes not very thick, almost or entirely glabrous, with slightly defined sides and rudimentary awn; glumelles well developed, white, standing out well at the base of the glumes. The interior of the caryopsis contains a very thin, light perisperm (coat) and a compact, vitreous endosperm (albumen), giving a very transparent, pearly, commercial product which is much appreciated.

Tillering is limited, but hardly inferior to that of most early rices, and the ratio between the weight of grain and that of straw is about equal to that of "Chinese originario".

Ripening occurs during the first days of September, whatever the date of sowing (from March to the first week of May) and is rarely as late as the middle of the month. The yield is from 1.79 to 1.83 tons of paddy per acre; under the best conditions this yield may reach and even exceed 2 tons per acre.

Examination of the culms, panicles, caryopses, etc., gave the following result :—

Average height of plant . . . . .	90-100	cm.
Length of panicles . . . . .	17-20	
Number of spikelets per panicle . . . . .	7-9	

In view of its great earliness the new variety does not attain the maximum yield of "Chinese originario". It is advisable to sow it rather closely, not less than 1.11 to 1.19 cwt. of paddy per acre and 1.36 to 1.43 cwt. per acre when it is sown very late in old fields with cold soil.

— *Bulletin de la Direction générale de l'Agriculture, du Commerce et de la Colonisation de la Régence de Tunis*, Year XXI, No. 92, pp. 158-184. Tunis, July, August, September, 1917.

A general outline of the economic and environmental conditions, parasites and diseases is given, followed by a description of the principal crops, containing information useful to all those interested in Tunis.

There are some Leguminosae among those described which are of particular interest. The cultivation of beans, horse beans and chick peas, already adopted over wide areas of the Régency, should be yet more widely extended. Lentils, one of the Leguminosae hitherto little cultivated, should do well and give a high yield per acre. Peas could also be grown with good results and fetch high prices; in normal times France imports nearly 900 000 cwt of peas annually.

The dwarf bean is less strong and needs favourable positions. For this reason its cultivation must be tested for some time before its extension can be recommended.

758 - *Canna edulis* in Trinidad.—FREEMAN, W. G., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Pt. 4, p. 174. Trinidad, 1917.

As in many other tropical countries *Canna edulis* is abundant in Trinidad and Tobago, where it is known as "tous les mois". It is cultivated in gardens, and, in cases where it has escaped cultivation, grows wild. The boiled roots may be eaten by human beings, and, in some countries such as Queensland, they are used for the extraction of starch. A sample analysed at Hawaii showed the following composition for the small and big roots respectively, the composition being similar to that of the potato:— Water

81.58, 65.86; nitrogen-free extract 15.57, 31.34; protein 1.37, 1.20, fat 0.13, 0.15, fibre 0.54, 0.64; ash 0.81, 0.81.

The plant is easily grown by planting pieces of the root at distances of 1 foot in rows 3 or 4 feet apart. It takes from 6 to 8 months to ripen, and, at Trinidad produces about 15 tons per acre. The roots keep well, and when stored in sacks do not decay for three months.

Recently (*Report of the Hawaii Agricultural Experiment, 1916*) the cultivation of this plant as a food for pigs was recommended.

**759 - *Canavalia ensiformis*, and *C. gladiata* in Trinidad and Tobago.** — SHERWESBURY, HERBERT S., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVI, Pt. 2, pp. 65-67; Pt. 4, pp. 224-225. Trinidad, 1917.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

Since 1915 *Canavalia ensiformis* has made considerable progress in Trinidad as a cover crop in coconut and cacao plantations. The fact that the dry beans (white) are edible makes it preferable to other cover crops. It is also a good quality forage. *C. gladiata*, is similar to the preceding plant, but of stronger growth with brownish-yellow or red seeds. It may be put to the same uses.

Analyses of the seeds, the results of which are given below, showed that the two species contain no hydrocyanic acid:— *C. ensiformis*. — Water 15.5, carbohydrates 45.2, protein 27.6, fibre 5.4, ash 3.1, fat 3.2, food units 122; weight of whole bean 1.97 gm., percentage of skin 14.4. *C. gladiata*. — Water 12.7, carbohydrates 53.6, protein 25.1, fibre 2.4, ash 2.9, fat 3.3, food units 125; weight of whole bean 2.73 gm., percentage of skin 15.5.

The nutritive value of these beans is equal, or even superior, to that of French kidney beans.

**760 - Growing Sorghum in Kansas.** — CUNNINGHAM, C. C. and KENNEY, RALPH, in *Agricultural Experiment Station, Kansas State Agricultural College Bulletin No. 218*, 54 pp., 15 tables, 24 Figures. Manhattan, Kansas, 1918.

The authors base their statements on experimental data and the experience of practical farmers in all parts of Kansas. The summary of their work is given below.

The sorghums are more resistant to heat and drought than maize. They are, therefore, more profitable in those sections where, because of drought, hot winds, and shallow soils, maize is not a reliable crop. Sorghum will outyield maize as a forage or silage crop in any part of the state.

Sorghum leaves the ground in poor condition for the following crop, and is therefore commonly considered hard on the ground. Pound for pound of material produced, sorghum does not remove more fertility than other crops.

Crops that make their growth during the latter part of the growing season should follow sorghum rather than autumn or early spring seeded crops like wheat or oats.

The varieties of grain sorghum most extensively grown in Kansas are Blackhull kafir, Pink kafir, Dwarf Blackhull kafir, Dwarf milo, and Feterita. Blackhull kafir gives best results with favourable conditions. Pink

kafir yields better than the Blackhull variety on poor soils or in unfavourable seasons, or where the growing season is too short for the latter. Dwarf milo and feterita and other early varieties are grown where the season is too short, or the rainfall too deficient, for Pink kafir. The varieties of the sorghos or sweet sorghums most extensively grown in Kansas are :— Black Amber, Red Amber, Orange and Sumac. The Red Amber is the best variety for western Kansas. Kansas Orange and an early strain of Sumac are best for eastern Kansas.

Three methods of planting the sorghums are employed in Kansas :— surface planting, open furrow planting, and listing. Surface planting is best on heavy, poorly drained soils in eastern Kansas. The open furrow method, which consists of seeding in rather shallow furrows made by two discs set on either side of the planter shoe, usually gives the best results in eastern Kansas, where drainage is good and rainfall abundant. Listing is practical, and generally the best method in western and central Kansas.

Usually the sorghums should be planted about ten days later than maize.

Rowed sorghum for grain should be seeded at the rate of 4 to 8 pounds per acre, depending on the soil and rainfall. If grown for forage or silage this amount should be doubled. Sorghum broadcasted or drilled for hay should be seeded at the rate of 1 to 2 bushels per acre. It should be sown later than sorghum for grain. Rowed sorghum should receive as thorough cultivation as maize.

The proper stage to harvest rowed sorghum depends on the purpose for which it is intended. Sorghum for feed should be cut when the grain is in the dough stage. For silage it should be cut when in the hard dough stage, or nearly ripe. For grain, it should be cut when fully mature. For syrup it should be harvested in the dough stage. Sorghum drilled or broadcasted for hay should be cut in the milk or soft dough stage. It makes the best quality of feed when it reaches the proper stage for cutting just before frost.

Sorghum cross-fertilises readily, which almost always results in deterioration. Continual roguing to remove hybrid and foreign heads is necessary to maintain a pure variety. Sorghum seed for home use should be field selected and kept in the head until planting time.

Sweet sorghum is utilized to a limited extent in Kansas for syrup production. This industry is increasing.

The grain sorghums, kafir, milo and feterita, when properly fed, are but slightly inferior to maize for feeding livestock. They are similar to maize in composition, but are not as palatable, and a smaller percent of the nutrients is digestible. Feeding tests carried out at the Kansas Agricultural Experiment Station indicate that they have from 85 to 90 per cent of the feeding value of maize for fattening hogs and cattle and from 90 to 95 per cent for fattening sheep. Sweet sorghum and kafir make excellent forage. Sorghum silage is about equal to maize silage.

The sorghums are comparatively free from diseases and insect enemies. Kernel smuts is the only serious sorghum disease in Kansas. This



can be readily controlled by treating the seed with formaldehyde (40 per cent solution). Chinch bugs, grasshoppers and the kafir ants are the only insect enemies that seriously damage sorghum in Kansas.

761 — Experiments on the Cultivation of *Paspalum dilatatum* in the Colonial Garden of Palermo. — *Bollettino di Studi ed Informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 2, pp. 54-57. Palermo, 1917.

*Paspalum dilatatum*, grown in the Colonial Garden of Palermo, did very well without irrigation. It reached an average height of from 3.38 to 4.92 feet. Sown in autumn it was already well developed in April. It was cut during the first days of June and yielded 14 tons of hay per acre.

762 — Oil Yielding Plants of Indo-China. — CREVOST, CH., in *Bulletin économique de l'Indochine*, Year XX, New Series, No. 127, pp. 563-619 + 18 Plates. Hanoi-Haiphong, November-December, 1917.

PLANTS  
YIELDING  
OILS, DYES  
AND TANNINS

The author (Agricultural and Commercial Inspector, and Curator of the Agricultural Museum), after having described the present situation in Indo-China with regard to the production of oil-yielding plants and oils, and its possible development, gives a detailed list of the oil-yielding species capable of being used industrially or commercially. The plants are studied, classified in families, with their scientific names, synonyms, common and native names, geographical distribution, description, extraction, and the quality and value of their oil.

Myristicaceae. — *Knema*, *Myristica glaucescens* Hook f. and Th. = *Knema corticosa* Lour = *M. corticosa* Hook f. and Thoms.

Bixaceae. — 1) Lucraban, *Hydnocarpus anthelminticus* Pierre. 2) Chaumoogra (1), *Taraktogenos Blumei* Hassk. — 3) False chaulmoogra, *Gynocardia odorata* R. Br.

Guttiferae — 1) *Calophyllum inophyllum* Lin. — 2) *C. Thorelii* Pierre — 3) *C. Balansa* Pitard. — 4) *Garcinia tonkinensis* In. Vesque, Cày-doc (2).

Ternstroemiaceae. — Tea-oil plant, *Thea sasangua* Nois = *T. oleosa* Lour = *Camellia drupifera* Lour.

Malvaceae. — Cotton plant: 1) *Gossypium herbaceum* Lin. and 2) *G. hirsutum*.

Bombacaceae. — Kapok of Indo-China: 1) Silk cotton tree, *Eriodendron anfractuosum* D. C. — *Bombax pentandrum* Lin. = *Eriophorpos Javana* Rumph = *Gossampinus alba* Ham. = *Eriodendron Rheedii* Planch. — 2) Silk Cotton Tree, *Bombax malabaricum* D. C. = *B. Ceiba* Lin. = *B. heptaphylla*.

Sterculiaceae. — 1) *Sterculia cochinchinensis* Pierre — 2) *St. foetida* Lin. — 3) *St. Pexa* Pierre. — 4) *St. Lævis* Wall. — 5) *St. alata* Roxb.

Meliaceae. — *Amoora* sp.?

Simarubeae. — 1) *Irvingia malayana* Pierre — 2) *I. Oliveri* Pierre.

Sapindaceae. — 1) Soapnut tree, *Sapindus Mukorossi* Gaertn.

(1) See R. Dec., 1917 No. 1166. — (2) See R., 1917, Nos. 436 and 854 (Ed.)

= *Paviesia annamensis* Pierre. — 3) *Schleichera trijuga* Wild. = *Melicoca trijuga* Juss. = *Sch. pubescens oleosum* Pierre. — *Stadmannia Sideroxylon* — *Cussambium oleosum*.

Anacardiaceae. — *Buchanania latifolia* Roxb.

Moringaceae. — Horse radish tree, *Moringa pterigosperma* Gaertn. = *M. oleifera* Lamk = *M. zeylanica* Pers. = *M. polygona* D. C.

Leguminosae. — 1) Pea nut, *Arachis hypogea* Lin. — 2) Soja = *Glycine Soja* Sieb. and Zucc. = *G. hispida* Miq. = *Dolichos Soja* Lin. = *Soja hispida* Moench.

Rosaceae. — *Parinarium Annamense* Hance,

Combretaceae. — Malabar almond tree, *Terminalia Catappa* Lin.

Cucurbitaceae. — 1) *Hodgsonia heteroclita* Hof. and T. — 2) *Momordica cochinchinensis* Spreng = *Muricia cochinchinensis* Lour = *Momordica mixta* = *M. dioica* Wall.

Pedaliaceae. — Sesame, *Sesamum indicum* Lin. = *S. italicum* Retz. = *S. orientale*.

Labiatae. — Perilla, *Perilla ocymoides*,

Sapotaceae. — Tonkin Bassia, *Dasilippa Pasquieri* M. Dub.

Lauraceae. — 1) Litsea, *Litsea citrata* Bl. — 2) *Teranthera sebifera* Pers.

Rutaceae. — 1) Shaddock tree, *Citrus decumana* Murr. = *C. costata* Rafn.

Euphorbiaceae. — 1) *Aleurites montana* Wils., 2) Candle nut tree, *Aleurites moluccana* Forst., 3) *Stillingia sebifera* Michx., this is the Cáy-soi (=tallow tree); this is followed by an extract of the report of M. GROSJEAN of the Lyons Mission in China, pp. 385-389; 4) *Rottlera sebifera*; 5) Croton, *Croton tigtium* Lin.; 6) Physic Nut tree, *Jatropha curcas* Lin., (1); 7) Makken; 8) Castor Oil, *Ricinus communis* Lin.; 9) *Hevea brasiliensis*

Urticaceae. — Hemp; 1) *Cannabis sativa* Lin. and 2) *C. gigantea*.

Coniferae. — Pine.

Palms. — 1) Coconut, *Cocos nucifera* Lin. — 2) Oil Palm, *Elaeis guineensis* Jacq.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

763 — Coffee in Abyssinia. — SPALLETTA, A., in *L'Agricoltura Coloniale*, Year XI, 1st. Half-Year, No. 1, pp. 70-88; No. 2, pp. 111-132 + 2 Plates; No. 3, pp. 196-222 + 1 Map; No. 4, pp. 284-297; Bibliography of 138 Publications. Florence, February 28, April 30, June 30, August 31, 1917.

WILD AND CULTIVATED SPECIES AND VARIETIES. — Coffee is not a native of Arabia, as many wrongly believe, but of the high mountains in the south-west of Abyssinia, where it grows wild and where the purest, most aromatic and most appreciated varieties are found. The wild or cultivated Abyssinian varieties are: "Ennaria" or "Naria", "Arrari" or "Arrarino", "Zeghié", "Gentel".

The "Ennaria" coffee plant is the stock from which all the other existing varieties are derived. "Ennaria" coffee closely resembles "Mocha"

(1) See R. Sept., 1917, No. 853. (Ed.)

coffee, with which it is sometimes mixed, and which it frequently surpasses in quality. It has two sub-varieties: — "Caffa" (the district where it originated) and "Ennaria" properly speaking, derived from the other Galla districts. The seed of the first variety is smaller, rounder, and of a darker green than that of the second, which is elongated.

The "Arrari" coffee plant takes its name from the place where it originated. This coffee is sometimes mixed with Mocha. There are two sub-varieties: — "Arraro", from near the town of Arrar, with elongated seed (hence its English name of "longberry"); "Ittou", in the district of the Ittou-Gallas and Arussis, with small, yellow seed; the colour is due to the fact that it is only put on the market 2 or 3 years after being harvested, so that it is thoroughly dry.

The "Zaghié" variety comes from the Lake Tzana district, near Zaghié and Quorata. It is the least appreciated quality on account of its lack of aroma.

The "Gentel" variety differs from the preceding one by the manner in which the seed is treated; it is produced and consumed almost exclusively in the Ouollo-Gallas district; it has a very agreeable, rather strong flavour.

CENTRES OF COFFEE PRODUCTION IN ABYSSINIA. — There are three principal centres: 1) the basin of the Omo and Didessa; 2) Arrar and neighbourhood; 3) Tzana Lake district in Godjam.

The first, by far the most important, is the original centre of the coffee plant which grows there wild on the hillsides and in the valleys at a height from 4 920 to 6 560 feet, forming almost exclusively the vegetation of the undergrowth, and sometimes of the clearings, in the forests. It is also cultivated. In the Lake Tzana district the coffee plant was introduced at a very remote date and has become semi-wild.

CLIMATE AND VEGETATION. — Abyssinia includes three large climatic zones: — 1) the lower or "quolla" called by the Gallas "worebo"; 2) medium or "voine dega" called by the Gallas "worebo angescho"; 3) upper or "dega", called by the Gallas "angescho". The first is a district of great depressions or valleys below 4 920 feet, hot, damp (as the result of water-courses, lakes, and periodical rains), with a luxurious vegetation. This zone is not cultivated because it is unhealthy; the natives go down there from the table-lands only to collect the ripe fruit of the wild coffee plants. The second zone is widely cultivated, with a perpetual spring, where all the European fruit plants flourish and give as much as three harvests a year. Its altitude is from 3 950 to 9 840 feet. The third, above 9 840 feet, is the zone of wide pasture lands, and above it are the eternal snows.

SOIL. — That of the Tzana Lake district is alluvial, cool and very fertile. In Arrar the coffee plant flourishes in granitic soils and ceases growing in the clay soils. In the Galla district the soil is volcanic and very fertile.

CULTURAL METHODS. — The woody or herbaceous vegetation of virgin soils is destroyed by fire. The soil is ploughed and sometimes, manured, and sown before the rainy season. The irrigation, even when

primitive, is practically sufficient. The sole cultural care is the removal of weeds.

Nurseries are rare in the Galla district. As a rule, at the rainy season, the natives go to the forest and choose young plants for sowing. These they place obliquely in the soil, with the earth attached to them, at a depth of from 12 to 14 inches, covering them with soil so that only about 4 inches of the plant is above ground. If an adult plant is used it is topped to about 7 inches.

When nurseries are formed the seeds are sown as soon as they are extracted from the ripe fruit. The young plants are only transplanted when they are at least 28 inches high, *i. e.*, at the end of one or even two years. Permanent plantations contain 800 plants. The first flowering occurs one year after transplantation and before the rains, *i. e.*, in April. The first harvest is made two years after the first flowering. The plant reaches a height of 10 to 16 feet (sometimes 20), and lives and bears fruit for 20 years, in rare cases 30.

In Arrar the cultivation of the coffee plant is rational and intense. In the Tzana district the plant is semi-wild and is not cultivated, the coffee alone being harvested.

Finally the author studies the commercial routes through which Abyssinian coffee passes and considers the future of the cultivation of the plant in that country.

**764 - Tobacco in Honduras.** — MAKINSON, G. A., in *Commerce Reports*, No. 288, pp. 950-952. Washington, 1917.

Honduran tobacco has always enjoyed a preeminent position in the estimation of Central American tobacco smokers, so much so that native tobaccos of the neighbouring Republics are often put on the market under the name of "Tabaco de Honduras" in order to obtain higher prices. It is commercially known as "Copan tobacco", because the best quality and largest quantities are produced in the Department of Copan, which borders on both the Guatemalan and Salvadoran frontiers. It is also produced in commercial quantities in the Departments of Ocotepeque, Gracias, Santa Barbara, and El Paraiso, the capitals of the respective Departments being the marketing centres. The estimated average annual production of each district is as follows: Paraiso, 7 500 lb; Santa Barbara, 250 000 lb; Gracias, 50 000 lb.; Ocotepeque, 410 000 lb.; and Copan, 1 000 000 lb.

*Planting, Harvesting and Curing.* — Tobacco is planted during October — that is, from 2 to 4 weeks before the close of the rainy season — so that the young plants have sufficient time to take root before the long dry season sets in. The seeds are planted in nurseries during July and the young sets transplanted about 4 months later. One pound of seed should produce approximately 20 000 plants, and growers place about 2 250 plants to the acre.

The leaves are ready for gathering between February and April and the custom is to start harvesting as soon as the plant has fully developed ;

this is sometimes determined by the appearance of yellow tints in the leaves or when the leaves show signs of brittleness on being doubled or bent. The stock is cut whole a little above the roots and the seed is obtained later from the suckers that sprout from the remaining lower part of the stem. The stocks are then hung out, head down, in the open air and exposed to the sun. If any are harvested in the rainy season (which is rare) they are dried in the shade. After being dried in the sun for 15 or 20 days the stocks are pressed for 3 days, and the leaves are then separated from the stems and sorted into 3 grades, according to size. They are then tied in bundles of 1 lb. each — the stems being utilized for fastening — and are alternately pressed and sunned until the veins are thoroughly dried. Owing to negligence and the varying judgements of different farmers the resulting product is not always uniform, which sometimes results in obtaining lower prices. Dried leaves average from 9 to 20 in. in length, and a well-cultivated acre should yield from 400 to 650 lb.

Both strong, mild, dark and light tobaccos are produced, these properties depending largely upon the nature of the soil and, to a somewhat lesser extent, upon the amount of rainfall and the time and method chosen for cutting and curing. If the plants are permitted to ripen thoroughly the leaves will be rather dark in colour, whereas if cut earlier a lighter shade will be obtained. A poor, sandy soil is said to produce a mild tobacco and a rich clay soil a somewhat stronger plant. In seasons of copious rainfall it is noticed that the leaves are invariably of a dark hue.

*Cost of Production.* — It costs from 8 to 12 cents United States currency to raise a pound of tobacco in Honduras, and the market price ranges from 15 to 25 cents, depending on the class and quality. It is supposed that most of the tobacco cultivated in Honduras was originally derived from Cuban seed, and the more progressive growers still continue to import Cuban, Jamaican, Porto Rican, and American seed. When ready for market Honduran tobacco closely resembles that grown in North Carolina and Virginia. It burns well and has a pleasant aroma, and connoisseurs state that its failure to achieve just recognition of its worth is due solely to the primitive and unscientific methods employed in its harvesting and curing.

*Methods of Packing — Export Trade in Tobacco.* — Tobacco is packed for shipment in bales of 100 lb. each, which are well wrapped in several layers of banana leaves and tightly tied with strong banana fibre. Although apparently crude, this method of packing is considered the most practical, combining as it does the qualities of lightness and cheapness.

As the tobacco fields of Honduras are in closer proximity to the railroads and seaports of Salvador and Guatemala than to those of Honduras, nearly all the crop is strapped on the backs of native Indian runners or mules and carried over the frontier trails to the neighbouring Republics. These caravans pass the border at remote hamlets, where no custom uses are established, so that statistics showing the volume of this trade are not available. However, it is well known that practically all of the high-grade cigars and cigarettes manufactured in Central America are either of pure

Honduran tobacco or contain a large admixture of it. The amount and value of tobacco exports through the seaports of Honduras for the years 1915 and 1916, respectively, were 56 800 lb., worth \$6 810, and 89 025 lb., worth \$19 610.

Honduras tobacco, after being manufactured into cigars and cigarettes in Guatemala and Salvador, is exported in considerable quantities to South America, particularly Peru, the Caribbean countries, and Europe. The volume of this business amounts to many thousands of dollars annually.

*Efforts made to expand industry and markets.* — Of recent years the Honduras Gouvernement has taken measures to foster the industry, and aside from maintaining several schools where young natives are taught to cultivate and cure the crop scientifically, steps are being taken to improve the quality of the plants and to find new outlets for the constantly increasing production. The Government recently sent several youths to the tobacco districts of Cuba, where they were able to study the up-to-date methods employed there in the various branches of the industry.

Tobacco is principally used in Central America for cigars and cigarettes; pipe smoking and chewing have not been introduced among the natives, although nearly all of them, including minors and women, smoke. Among the labouring classes the women of nearly every household prepare the cigars and cigarettes for the family needs. During the fiscal year 1914-15 \$7 480 worth of cigarette paper was imported, the greater part of this supply coming from Spain and small shipments from the United States and Germany.

Up to the present no attempts have been made to manufacture high-grade cigars or cigarettes on a large scale, although with an abundance of raw material and cheap labour it would seem to warrant a careful investigation. Nearly every man and woman of the labouring class understands the rudiments of cigar making, although none of them are particularly expert at it. However, they could soon be trained to turn out as good cigars as are manufactured in Cuba. An almost unlimited supply of this labour could be obtained at from 25 to 50 cents per day. Cigar factories in Guatemala utilize native labour and their products (Honduras tobacco with Sumatra wrappers) are said to compare favourably with those of many factories in Cuba, Porto Rico, and the Philippines.

In addition to supplying the demand for good cigars in Honduras itself, a profitable market could be worked up among the other Central American Republics.

#### VARIOUS PLANTS

##### 765 — *Marvel of Peru (Mirabilis Jalapa)*, a Plant which should be Utilised —

MANCADA-GUIGNONNE FRANCISCA in *la Revista Agrícola*, Year XVI, Pt 372, pp 112-113, Rome, May 1 1928.

The author has made a long study of this plant and concludes that its cultivation for various industrial uses is advisable.

When grown in gardens the plant flowers excessively to the detriment of the seed which is small. In arid soil, however, especially if fertilised with ash, it flowers less and the seeds are much larger and richer in starch.

The stamens, pistils, and perianth (which dries up without separating from the seed) give a fast purplish colour which dyes silk.

The starch contained in the seed is of very good quality. When freed from the husk and germ the seeds give a very fine flour, which may be used for making bread, paste, biscuits, etc.; they may also be subjected to alcoholic fermentation as they contain a sugar.

The cultivation of this plant in malarial districts would be very advantageous; the flowers open in the evening and during the night give off a very strong, small which keeps away mosquitoes, or stupefies them, thus making them inoffensive.

766 — “Chamiso” (*Atriplex canescens*) and “Quelite Salado” (*Atriplex acanthocarpa*), Plants of the Arid Districts of North Mexico Suitable for growing in Saline Desert Soils. — PARON, CARLOS, in *La Revista Agrícola, Órgano oficial de la Dirección de Agricultura, Secretaría de Fomento, México*, Vol. 1, No. 2, pp. 18-49 México, September 15, 1917

“Chamiso”, or “costilla de vaca”, or “costilla” (*Atriplex canescens*) is found in northern Mexico, New Mexico and Texas. The variety most common in Mexico is *angustifolia*, which prefers rich, strong land, and, though not of necessity halophytic, also does well in medium soil, and can stand perfectly well sodium salts such as chloride or carbonate. It grows to a height of from 3.28 to 4.92 feet and its foliage is about 6.56 feet in diameter. Its leaves are tender and good as forage. The wood is used as fuel.

The “quelite salado”, or “saladillo” (*Atriplex acanthocarpa*, which must not be confused with another plant also called “saladillo”, the Chenopodiaceae *Suaeda Torreyana* or *S. Moquini*) is found in the same districts as the preceding species, but is smaller and of more rapid growth because almost entirely herbaceous. It is always halophytic. Its leaves are more tender and appetising, and sodium is extracted from its ash.

The author recommends that these plants be sown or transplanted to cover the dried-up soil of the old bed of the Lake of Texcoco.

767 — The “Miaray” (*Citrus miaray* n. sp.), a New Citrus Fruit of the Philippines. — WESTER, P. J. (Agricultural Adviser, Department of Mindanao and Sulu), in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 450-457 Manila, 1917

The Philippines already hold first rank in the number of indigenous forms of the genus *Citrus*, and this very fact is a promise of discovery of still unrecorded species in the less explored regions of the Archipelago. Apart from a purely botanical point of view, new forms are at present also of great interest, as opening up new possibilities in hybridization, especially in connection with the problem of breeding new types resistant or immune to the citrus canker *Pseudomonas citri* Hassk.

The “miaray” (*Citrus miaray* n. sp.), described and named by the author, was found by him in August, 1917, in Impolunao in the interior of the Province of Bukidnon, Mindanao, at an elevation of 750 metres.

With its willowy, slender, drooping branches and dense crown of dark green foliage, the miaray is an exceedingly handsome ornamental tree

FRUIT  
GROWING

about 6 metres in height. The fruit is about the size of a lime. It is pleasantly acid and may be used like the lime. The clean, vigorous growth of the tree indicates that it is likely to prove a desirable stock for other cultivated varieties of the citrus.

768 — **Soil Management Investigations in a Young Apple Orchard.**— WOODBURY, C. G., NOYES, H. A. and OSKAMP, JOSEPH, in *Purdue University, Agricultural Experiment Station, Bulletin* No 205, Vol. XX, 52 pp., XXIII Tables 12 Figs. Lafayette, Ind., September, 1917

The object of this investigation (carried on at Laurel, Indiana) has been to study the effects, and particularly the factors responsible for the effects of tillage with cover crop, mulch and sod on apple trees. The present report covers the formative period of the life of the trees. The land comprising the experimental plots had been used as a permanent pasture for nearly 40 years previous to planting the orchard. The investigation has to do mainly with the upland area, the hillside plot being included for any additional light it might throw on the behaviour of the upland plots. The systems of soil management include four major treatments, viz., clean cultivation with a winter cover crop; a heavy mulch of straw applied to the trees and the grass cut and let lie; the grass cut and allowed to lie where it falls, no mulch given the trees; the grass cut and raked up to form a mulch collar about the trees.

The Laurel soil contains a high percentage of silt and clay, and varies but little in its physical composition, specific gravity and water-holding capacity. The soil (to a depth of 9 in.) is not notably deficient in any essential element, however it is not very productive. The low organic matter content and the high proportions of silt and clay, make the soil one through which water percolates slowly and one which is easily puddled; coupled with these conditions is a slight acidity. The subsoil is not greatly different from the surface soil.

The average annual precipitation during the five-year period 1912-1916 has been 38.71 in. The spring months are usually much better supplied with moisture than the autumn months. Periods of dry weather frequently prevail in June and July, which are commonly broken by heavy precipitations in August.

While there have been no wide variations in phenological behaviour of trees under different systems of soil management, yet there does occur a marked slackening up of growth on grass plots during dry periods in summer.

Trees grown under a clean culture cover crop system or under a heavy mulch made 44.5 per cent greater average yearly gains in trunk girth than trees grown in grass with a light mulch or no mulch at all. There was no significant difference between the three varieties, Grimes, Jonathan and Stayman, in their response to soil management treatments. The Stayman variety made slightly greater gain in girth of trunk on all plots than did Grimes or Jonathan.

It is largely in dry periods that the value of certain systems of management in conserving soil moisture are made manifest. During two such



periods, occurring in June two out of the five years, where an adequate mulch was maintained on the surface of the ground either through the agency of cultivation or a heavy supplemental covering, the percentage of soil moisture was more than twice that in grass land. These soil moisture conditions are closely correlated with the girth increase made by the trees. The great importance of water in tree growth is further emphasized by a study of the precipitation data which show that the variation in growth due to seasonal moisture conditions, appears to have been quite as large as that due to cultural practices.

The soil temperature studies were carried out under field conditions (at a uniform depth of 9 in. on all plots) by means of soil thermographs. As the soil temperature is largely a reflection of the air temperature, the extent to which soil temperature can be controlled by cultural practices is quite limited. The data do not support the opinion that rain is of importance in warming the soil. There is no indication that the single factor of soil moisture had an influential bearing upon the temperature existing under the different systems of soil management. The temperature range varies inversely with the amount of mulch covering the soil. The role of soil temperature within the limits of ordinary cultural practice appears to be a neutral factor in tree growth in Indiana.

From a study of the chemical changes induced in the Laurel soil by cultural practices during the period 1910 to 1915, it appears that clean cultivation tends to deplete the soil of its organic matter, despite the fact that a cover crop is being turned under each year. The straw mulch plot has increased slightly in organic matter while the sod plots, as a whole, have come nearer to holding their own in volatile matter, humus and nitrogen than the clean culture cover crop plots. There is no apparent correlation between the previously mentioned chemical factors and tree growth.

A study of the average bacterial population shows that there are, in most cases, more bacteria present in the sod ground at Laurel than in the clean culture cover crop plots; that the variations in mulch on the sod plots have some influence on bacterial numbers; that tree growth and soil moisture cannot be correlated with bacterial numbers (1).

Tests show that ammonification varies with the season. Differences between plots are not consistent with seasonal climatic variations and it is impossible to say that cultural practice has affected the ammonifying power of this soil. Tests show that nitrification varies with the season, but that a growing crop of grass or rye lowers the nitrate content of the soil; that the most nitrates are found under the clean culture cover crop system, the straw mulch ranking second in amount of nitrates; that the girth gains of the trees are roughly proportional to the nitrate content of the soil; that there is no relation between the nitrifying power of the soil and either cultural practice or tree growth; however, the ratio between the nitrates present in the field and the nitrifying power of the soil does bear a relation to tree growth.

(1) See also *R.* April 1918, No. 391. (*Ed.*)

769 — **Experimental Projects of the Division of Pomology of the University of California.** — See No. 724 of this *Review*.

## VINE GROWING

770 — **The Present Position of Hybrid Bearers.** — PEE-LABY, E., in *La Vie Agricole et rurale*, Year VIII, No. 13, pp. 219-221., Paris, March 30, 1918.

The author summarises the principal results of the annual report of the Commission of Investigation of the Central Agricultural Society of Haute-Garonne. This forms an interesting supplement to his study published in the same journal\* (1).

The cultivation of hybrids increases each year. It is taking foot in the fine wine-producing districts, such as Burgundy, Bordelais, etc., not to oust the established wines, but to supply the workers of the district with a very cheap, good ordinary wine, owing to the little care these vines require.

The Commission carried out its investigations chiefly in the department of Haute Garonne, and the departments bordering on it. The south-west of France is, moreover, the district in which hybrids are most extensively grown.

1. — **OLD HYBRIDS (BLACK).** — *Seibel* No. 1. — Does well direct in loam; irregular and small yielder in calcareous soils; very subject to anthracnosis under certain conditions.

*Seibel* Nos. 2\* and 63. — Larger producers and less sensitive than No. 1, especially 63; wine poor in alcohol; easily protected against mildew.

*Seibel* 128 \*. — Was the most remarkable in 1917 on account of its fine, heavy yield, but it is very uncertain; very slightly subject to anthracnosis.

*Seibel* 138 \*. — More regular and stronger than 128; its wine does not derive its colour from the pulp; largely grown because it can be planted direct.

*Seibel* 156 \*. — Low resistance in certain environments, especially lime; must be fairly well protected against disease.

*Seibel* 1000 \*. — To be preferred because of its greater resistance to disease and better quality wine; anthracnosis sometimes causes it to non-set in damp districts.

*Seibel* 2007. — Much in demand on account of its large fruit and its regularity in spite of its incomplete ripening.

*Seibel* 2003. — Does very well in loam; affected by lime.

*Coudere* 7103 \* and 4401 \*. — The first is preferred because it gives a larger yield, though the quality is inferior; subject to oidium.

*Coudere* 7120. — More popular than the two preceding ones because almost immune to oidium when planted in a relatively warm district or in an exposure which allows it to ripen its grapes which are of the third period.

*Coudere* 503. — Does not appear to propagate except at the beginning of hybrid planting; resistant to blackrot.

1. **NEWER HYBRIDS.** — *A. Black.* — *Seibel* 4121 \*. — Much in demand on account of its good resistance to disease and regular yield.

*Seibel* 4643 \*. — Much appreciated for its delicate and large grapes; needs sulphur spraying although not very subject to mildew.

*Coudere* 106-46. — Regular yield and high resistance to mildew.

*Maléque* 829-6 \*. — Notable for the size of its bunch and grapes and its good quality wine; easily protected against mildew.

(1) See R. March, 1918, No. 303. To avoid repetition and to facilitate reference the hybrids already mentioned in article 303 are marked with an asterisk (\*). (*Ed.*)

*Malègue* 1551-2 \*. — Heavier producer than 829-6; is better adapted to the eastern Pyrenees than the south-west because it requires more heat.

As a general rule *Malègue* vines should not be grown in soils favourable to anthracosis.

*Gaillard* 194 \*. — Appreciated for its regular yield, which is average and does not need protecting when there is an invasion of mildew; in the Centre and East this vine is in demand on account of the quality of its wine; in the South and South-West where Aramon products are usual, those of 194 are considered too weak; its yield has been appreciably increased by long pruning.

*Jurie* 580 \*. — Gives a high yield and is very resistant to diseases.

*Baco* 1. — Little grown in the South-West on account of its small fruit and excessive earliness which necessitates picking a fortnight before the normal harvest.

*B. Pink*. — *Seibel* 2859 \*. — Is being more and more widely grown; strong foliage which does not require sulphate spraying when in a good exposure; suffers from excessive moisture which may be seen by the beginning of rot on the bunches.

*C. White*. — *Seibel* 793 \*. — Almost immune; turns grey-pink when ripe; regular and fairly vigorous when planted ungrafted in good soils; its wine, though not very fine, is not of a bad flavour and fairly alcoholic.

*Seibel* 850 \*. — Stronger; larger fruit; regular; foliage easily protected.

*Seibel* 880 \*. — Grown a little everywhere; wine better than that of 850, used in the South-West for making sparkling wine.

*Seibel* 2653 \*. — Known as *Flot d'or*.

*Seibel* 3021 \*. — Is without doubt a hybrid of the future; was much in demand in 1917.

*Seibel* 4681. — More resistant than 3021.

*Gaillard* or *Girard* 157. — Much spoken of; found by some to have too low a resistance; must be treated with sulphate 2 or 3 times, and with sulphur, 1 or 2 times; others consider it a large regular yielder of good grapes and worth the necessary treatments; the Commission found it in all the vineyards visited.

*Couderc* 235-120 \*. — Good yield and resistance, but rots regularly before ripening.

*Malègue* 1647-8. — Known as *Vert doré*; grapes of excellent flavour; foliage of good practical resistance.

*Malègue* 1157-1 \*. — Slightly less resistant but larger yielder.

*Malègue* 1897-12 \*. — Rather pretty bunches with a slight musk flavour.

*Bertille-Seynes* 450. — Fine bunches with average fruit, slightly foxy and ripening in the second period.

*Maurice Baco*. — Fine foliage, heavy yield; maturity somewhat too late for certain districts of the South-West, slightly subject to mildew and especially grey rot.

III. — NEW HYBRIDS. — *A. Black* (1).

*B. White*. — *Seibel* 4657 \*. — The author corrects his previous remarks (2); this vine did so badly after the turning point that he has removed it from the list of plants to be recommended; as soon as ripe the grapes become loose and drop one after the other without the slightest shake; at vintage time only the bare stalks of the bunches remain.

*Seibel* 4603 \*. — Another correction; at harvest time it is almost completely rotted; the author discards it too.

*Seibel* 4762. — Good resistance to mildew; neither bunches nor grapes are very large; but are excellent and very sweet, ripening in the second period.

*Seibel* 5451. — Higher yield than 4762, with much larger bunches and fruit, round, ripening at the end of the first period; not very subject to rot; foliage less strong requiring some sulphate; grapes very sweet and of good flavour.

(1) There is nothing to add to that contained in No. 303 of March, 1918, p. 362. —

(2) See No. 303, p. 361. (*Ed.*)

*Seibel* 4905. — Good yield; fine, well-flavoured grapes, less sweet than the two last; very regular; strong foliage resistant to mildew; ripening in the second period.

*Seibel* 5770. — Fine yield of good bunches with fruit above the average, ripening in the first late period; though very close the grapes do not rot; they are very good and very sweet.

FORESTRY

771 — **The Larch.** — SCHOTTE, J. (Meddelanden från Statens Skogsförsöksanstalt), in *Skogs-vårdsföreningens Tidskrift*, Year XV, No. 4-6, pp. 445-706 + 107 Figs. + 11 Tables. Stockholm, 1917.

This paper is a study on the genus *Larix* and its different species spread through the various countries of the globe made in view of their importance to silviculture in Sweden. At the same time it is an important contribution to silviculture in all countries. The author and his collaborators study above all the identification and geographical distribution of the different species of larch known throughout the world, their varieties, forest characteristics, susceptibility to disease and insect attack, production of wood, the quality and utilisation of this wood and the division of the different species of larch into pure and mixed stands. To distinguish the species are given two tables of identification, which enable the forester to distinguish 11 species of the 16 already known.

*Classification table of larch, based on the cones.*

I. — CONES VERY DEVELOPED (exceeding 2 to 2.5 cm. in length).

A) Bracts longer than the scales.

a) Straight bracts.

1) Scales with even edges . . . . . *Larix occidentalis* (1)

2) Scales with cut edges. . . . . *L. Lyallii* (2)

b) Curved bracts.

1) Cones 7 to 10 cm. high. . . . . *L. Griffithii* (4)

B) Bracts shorter than the scales.

a) Straight scales.

1) Bracts visible, ripe cones with neither hair nor down.

α) smooth twigs. . . . . *L. europaea* (7)

β) slightly downy twigs . . . . . *L. Potanini* (5)

γ) hairy twigs. . . . . *L. olgensis* (14)

2) Bracts usually invisible, ripe cones with down or hair. . . . . *L. sibirica* (10)

b) Scales with curved point . . . . . *L. leptolepis* (6)

II — SMALL CONES (Less than 2 to 2.5 cm in length)

a) very small cones (length 1.5 to

2 cm.) . . . . . *L. americana* (18)

b) cones rather larger (length up to 2.5 cm.)

1) Leaves about 3.5 cm. long. . . . . *L. dahurica* (12)

2) Leaves about 2 cm. long. . . . . *L. kurilensis* (15)

It should be noted that *L. chinensis* is not included in this table, though according to the descriptions available, its cones are very similar in character to those of *L. americana*, whereas the cones of *L. europaea* show considerable differences in measurements and form.

*Classification table of larch, based on the twigs and leaves.*

I. — HAIRY OR DOWNY TWIGS.

- A) TWIGS COVERED WITH A GREYBROWN DOWN . . . . . *L. Lyallii* (2)
- B) TWIGS SLIGHTLY DOWNY OR HAIRY
- a) Leaves blueish-green, twigs reddish
- 1) Leaves about 2 to 3.5 cm. long. *L. leptolepis* (6)
- 2) Leaves about 2 cm. long. . . . . *L. kurilensis* (15)
- b) Leaves green.
- 1) Twigs pendant, reddish when young, slightly hairy, leaves long (up to 4 cm.) . . . . . *L. Griffithii* (4)
- 2) Twigs non-pendant, upright, yellowish when young, downy, leaves long (up to 3 cm.) . . . . . *L. occidentalis* (1).

II. — TWIGS SMOOTH.

- A) LEAVES RELATIVELY LONG (3 to 5 cm.); twigs dry with a strong smell of jasmin . . . . . *L. sibirica* (10)
- B) LEAVES OF AVERAGE LENGTH (2.8 to 3.5 cm.); twigs fresh with a slight smell of balsam. . . . . *L. dahurica* (12)
- C) LEAVES RELATIVELY SHORT (rarely more than 3 cm.) . . . . .
- a) Twigs greyish-yellow, often with a slight smell of jasmin when dry . . . *L. europaea* (7)
- b) Twigs reddish with small cones . . . *L. americana* (18)

The appended map (see p. 830) shows the geographical distribution of the various larches (16 species and 3 hybrids).

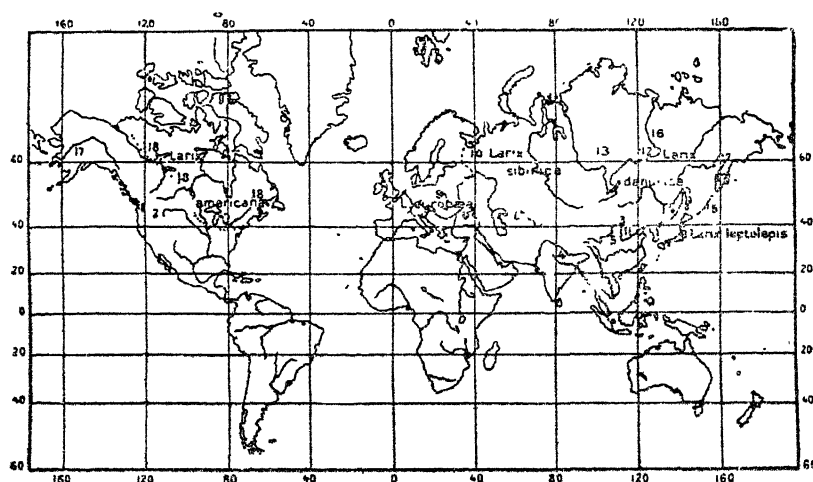
The following details are given on the use of larch in silviculture, especially with regard to Sweden, for the most suitable species.

The European larch is grown almost all over Sweden up to Haparanda; it was imported in 1750 and the first plantations made in 1780 with seed obtained chiefly from Scotland. The plantations are remarkable for the size and regularity of the trunk and not very thick top, which has led the author to believe that there is a Scotch variety of the European larch. Since the middle of the 19th. century a large part of the larch seed used in Sweden was imported from the Tyrol, giving plantations with a high proportion of twisted trunks and of bad shape with an insufficient growth in height and a thick top. These characters make the Tyrolese larch unsuitable for mixed stands and of little value for the production of wood.

Scotch larch, on the contrary, may be profitably cultivated in the best forest soils, and soon produces timber ready for sale in about  $\frac{1}{8}$  of the time the Scotch pine requires to do so. Since the larch is fairly often subject to canker (produced by an ascomycete, *Dasyscypha Willkommii*), it is advisable to form plantations mixed with other trees wherever possible. For this

purpose plantations of Scotch larch mixed with Scotch pine or birch are to be specially recommended; spruce should be avoided, and, in any case, treated as a dominated tree. It is also advisable to use only seed of Scotch and Silesian larch, even though produced locally. The thinning of European larch should be early and intense, so that the first frees the tops and liberates the plants dominated. Intense low thinning should then be practised to eliminate the dominated trunks with bushy tops, especially if there is a dominated class in the plantation. These methods make the plantation more resistant to canker; to avoid attack by this disease trees of 20 to 30 years should be cut. European larch wood is appreciated for use as timber, for scaffolding, telegraph and telephone posts, and supports of all kinds. It keeps much better when in contact with soil than does Scotch pine.

*Map of the approximate geographical distribution of larches.*



1) *Larix occidentalis*. — 2) *L. Lyallii*. — 3) *L. chinensis*. — 4) *L. Griffithii*. — 5) *L. Potanini*. — 6) *L. leptolepis*. — 7) *L. europaea*. — 8) *L. europaea* × *leptolepis* (cultivated in England). — 9) *L. polonica*. — 10) *L. sibirica*. — 11) *L. Principii Rupprechtii*. — 12) *L. dahurica*. — 13) *L. dahurica* × *sibirica*. — 14) *L. olgensis*. — 15) *L. kurilensis*. — 16) *L. Canderi*. — 17) *L. alaskensis*. — 18) *L. americana*. — 19) *L. americana* × *europaea* (cultivated in England).

Siberian larch is to be recommended for plantations in central and northern Sweden. Like the Scotch larch its trunk is high and straight. As it is equally subject to canker, the same care is necessary. Its wood has qualities similar to those of Scotch larch.

*Larix leptolepis* is a species suited to plantations in south Sweden. It grows rapidly in height and diameter, though the rate of growth begins to decrease at an earlier age than that of the two previous species. Although also attacked by canker, it bears shade better than the other larches. On

account of its thick top it is not suited to mixed stands, but only to those on good soil where a heavy production of wood is required in a short time. Its wood is less appreciated than that of the other larches.

*L. occidentalis* is comparable to the European and Siberian larches. Like them it is subject to canker. As it produces the best resinous wood in America, experimental plantations of it are recommended.

772 - **Forest Trees of the Argentine.** — *Revista forestal*, 1st Year, No. 8, pp. 176, 179, 184; No. 10, pp. 243, 255, 260; No. 11, pp. 283, 292, 297; No. 12, pp. 335, 341, 345; 2nd Year, No. 15, pp. 449, 451; No. 17, pp. 499, 503, 507. Buenos-Aires, July, September, October, and November, 1917; January and February 1918.

Concise descriptions are given of the various uses to which the following trees may be put, with one or more plates of each.

"Espinillo aromita" (*Acacia Aromia* Gill. = *A. macracantha* Humb. and Bonpl.). Supplies fire wood and flowers from which a scent may be extracted.

"Iba-Jay" (*Eugenia edulis* Benth. Hook). Wood for cooperage, carpentry, joinery; tanning bark; flowers may be used for extracting scent; fruit may replace that of the tamarind.

"Iba Eé" (*Acanthosyris spinescens* Gr.). Wood for furniture making; fruit (nuts) gives a very alcoholic brandy; tree very ornamental and easily propagated.

"Espina de corona" (*Carugandra amorphoides*). Very compact and flexible wood for joinery. A Leguminosae all parts of which are rich in tannin. Bark, sap-wood and fruit rich in saponin, in which the fruit is especially rich, and used commercially to free hair, as well as woollen and silk materials, from fat.

"Aliso" (*Eupatorium* sp.). Compositae, very abundant on the banks of the Paraná and Paraguay, as well as on the islands and banks of the Bermejo. Wood white, light, used for field constructions and the manufacture of casks; suitable for paper-making.

"Guabiyú" (*Eugenia Guabiyú* and *E. pungens*). Very fine joinery wood; bark, leaves and branches have tanning qualities; edible fruit.

"Sauce blanco" (*Salix Martiana* Leyb. = *S. Humboldtiana* Willd.). Light wood used for making clogs and all light articles. Very abundant in moist soils. — "Sauce colorado" (*Salix Humboldtiana*). Reaches a maximum height of 50 feet; requires less than two years to attain complete growth. Excellent wood for furniture making. Like the preceding tree it does well on moist soils and is excellent for making fibre and paper pulp.

"Urunday-urá" or "Urunday blanco" (*Diplokeleba floribunda*). Wood for furniture making.

"Trementina", or "Molle", or "Molle guazú" (*Duvana praecox* Griseb. = *Schinus dependens* Ortega). Unlike the preceding trees which are all large, this Anacardiaceae is a bush; when incised it yields a resin; the leaves give an infusion used for the teeth; very fine pink wood.

"Toro-ratay", "Huiflag", or "Palo cruz" (*Tabebuia nodosa*). Santalaceae, 26 to 33 feet high; yellow wood of which the handles of tools are made; used in dying.

" Ivira pitá '(*Peltophorum Vogelianum* Benth). Leguminosae with tanning bark ; the pinkish-yellow wood, is used for cabinet-making, and more largely for making casks. " Ivira-pitá-guazú » (*Peltophorum rubium* = *P. Vogelianum*). A gigantic tree with hard, yellow wood ; medicinal fruit, leaves, and roots.

" Palo santo blanco " (*Bulnesia Gancedii*), known as " Guaiacum officinale " in Brazil, where it was imported from Jamaica. In the Argentine it is found with the preceding species ; fine, resistant wood of a dark green or blue ; used for buildings or as fire wood ; depurative infusions are made from it. The resin from the bark and sawings is used as a balsam.

" Inga " (*Inga affinis*). Large tree growing in moist soils ; edible fruit ; white wood not very resistant to inclement weather ; the bark contains a fine red colouring matter and is used in tanning ; by mixing an infusion of the bark with ferrous salts a blue-black ink is obtained.

773 - Swiss Forestry from 1914 to 1917. — I. DECOPPET, M. (Chief Federal Inspector of Forests). Allgemeine Orientierung über die Holznutzungen in den Jahren 1914-1916. *Schweizerische Zeitschrift für Forstwesen*, Year LXXVIII, No. 7-8, pp. 214-219. Berne, 1917. — II. BADOUX, H., Notre Commerce de bois avec l'extérieur en 1916, in *Journal forestier suisse*, Year LXXVIII, No. 7-8, pp. 129-133. *id.* — III. BALSIGER, Die Holzschlagspolizei in den privaten Nichtschutzwaldungen nach dem Bundesratsbeschluss vom 23. Februar, 1917, in *Schweizerische Zeitschrift für Forstwesen*, Year LXXVIII, No. 9-10, pp. 237-244. *id.* — IV. SCHÖNENBERGER, F., Betrachtungen zu der Schutzwaldfrage, *Ibid.*, pp. 245-249. — V. HERTI. Referat zur Motion Engler, *Ibid.*, pp. 249-262. — VI. BLOLEY, H., Rapport sur la " gestion directe ", in *Journal forestier suisse*, Year LXXVIII, No. 9-10, pp. 166-174, *id.* — VII. BADOUX, H., Réunion de la Société suisse des forestiers, les 25 et 26 août, à Lumpenthal, *Ibid.*, pp. 181-188. — VIII. Résolution pour la fourniture des bois de feu. *Ibid.*, p. 188. — IX. TUSCHMID, Die forstwirtschaftliche Zentralstelle, *Schweizerische Zeitschrift für Forstwesen*, Year LXXVIII, No. 11, pp. 285-292, *id.* — X. MURET, E. (Président de la Société des forestiers suisses), Rapport du Comité pour l'année 1916-1917, *Journal forestier suisse*, Year LXXVIII, No. 11, pp. 203-207, *id.* — XI. Rendement financier, en 1916, de quelques forêts communales à gérance technique. *Ibid.*, No. 12, p. 227.

According to a publication of the Chief Federal Inspector of Forests (a report read at a conference of delegates from the various federal departments and of Swiss forest inspectors) the influence of the war on Swiss forestry and forest industry has been very great. Before the war the wood production of Switzerland was insufficient for the requirements of the country and had to be supplemented by about  $\frac{1}{4}$  of the native production. In 1913 the difference between the exports and imports of wood was over 85 million cubic feet. In 1914 the imports still exceeded the exports by 3 %, but in 1915 the position was reversed and the exports were equal to the 1914 imports, and about double those of the year 1915. In 1916 the exports exceeded the imports by three times in quantity and four times in value. Italy and France received most of the wood exported, Germany only occupying the third place.

The excess of exportation of wood, the setting aside of certain quantities for yards, and the decreased coal supply which has necessitated the use of wood for gas-making, has led to an abnormal rise in price, and a certain shortage of fire-wood. The Government has had to take various special



measures — the fixation of maximum prices, permission for extraordinary felling of fire wood, and to exceed the felling provided for in the management of public forests, and cooperation in the work of utilisation. Moreover the export of certain wood-products has been forbidden and that of others regulated by special permits. At the same time the felling of walnut trees has been prohibited, the cutting of wood belonging to private individuals controlled, and the penalties for cutting wood in the lands under forest control increased.

The felling of trees in the public forests has not been excessive, but not a few privately owned young plantations not under forest control have been sacrificed. Thoughtless felling will result in a marked depression in wood production for many years.

On the whole the normal amount of wood cut in Switzerland amounts to over 7 431 270 000 cubic feet, whereas, in 1916, it rose to over 14 154 800 000 cubic feet. To prevent ultimate loss the regulations previously applied to controlled forests have been applied to the other forests, and it is possible that this control may be continued even after the war. On the other hand it is proposed to improve the conditions of forestry and utilisation of wood by increasing the public forests.

An important event was the meeting of the Association of Swiss Foresters (autumn of 1917), the chief object of which was to discuss the report of a Committee of action, nominated in 1911 with a view to improve both the position of Swiss foresters and the technique of forestry. The war has helped the attainment of this object because it has proved to the public the importance and economic value of forests.

The value of the Swiss forests, calculated on a 3 % yield, is over £ 58 000 000, or about the total of the debt for the federal railways at the end of 1915, whereas there are only 200 officials to administer the public forests, which have a minimum value of over £ 26 000 000. More recognition of the work of the forest officials and greater freedom for them in the management of the public forests are, therefore, demanded. A more technical and intensive management even of the private forests is also demanded, as this would mean a marked increase in the quantity and value of the wood per acre.

In support of this M. BIOLLEY gives data concerning a communal forest of 283  $\frac{1}{2}$  acres at an altitude of from 2 424 to 3 608 feet which had been devastated by successive fellings, neglect and destructive utilisation by its contractors. For 50 years this forest has been controlled. As a result during the last 25 years the amount of wood has been increased, and age, volume per tree and growth have been improved. Whereas it yielded 39.5 cubic feet per acre in 1891, in 1916 it yielded 103.6 cubic feet. As a result of good management the cutting even exceeded the estimated amount, reaching 115.3 cubic feet in 1916.

The chief demand of the meeting was for a revision of the forest legislation in force in Switzerland in order to extend the principle of forest control, even from an economic standpoint. As has been done by the Swiss Society of Timber Merchants, the Society of Swiss Foresters proposes to

form a central forestry office which will supply information, give commercial technical help, and undertake propaganda. With this aim in view two publications are being prepared which will be largely distributed; the object of one is to show the extent to which the yield of public and private forests may be increased, that of the other to show the work forestry demands from experts.

For 1916 the financial yield of some of the technically managed communal forests showed a marked increase, although this was not due to excessive felling. Thus a minimum of £ 1.15.0 per acre for the Bernese communal forests, corresponding to a utilisation of 97.1 cubic feet, rises to a maximum of £ 6.0.0 for the communal forests of St. Gall, corresponding to a utilisation of 154.2 cubic feet per acre. The cost of exploitation is not included in these estimates.

### LIVE STOCK AND BREEDING.

#### HYGIENE

774 — **Studies on Toxicity to Insects of Various Organic Compounds** — MOORE, WILLIAM: I. Toxicity of Various Benzene Derivatives to Insects; II. Volatility of Organic Compounds as an Index to the Toxicity of their Vapours to Insects, *Journal of Agricultural Research*, Vol. IX, No. 11, pp. 371-381 4 Figs Bibliography of 7 publications, and Vol. X, No. 7, pp. 365-371. Washington, June 11 and August 13, 1917.

I. — The author in a previous paper (1) pointed out the possibility of fumigating animals with nitrobenzene to destroy their external parasites. In that work and in later experiments with nitrobenzene as many as 500 animals (cattle, sheep, hogs, chickens, dogs, cats, rats, and guinea pigs) have been fumigated, with only two cases of possible poisoning. Nevertheless, in view of the extreme toxicity of nitrobenzene, it was felt that it might be too poisonous for general use. For this reason a study of 28 benzene derivatives was undertaken with a view to determining their toxicity to insects; and from the result of this study it was hoped that one or more compounds might be found which would be quite toxic to insects while non-toxic to higher animals or plants. A knowledge of the toxicity of the vapour of these compounds is valuable not alone for fumigation purposes but also as an index of their work as contact sprays, since SHAFER and, more recently, MCINDOO have shown that most contact sprays kill by the action of their vapour rather than by the plugging of the spiracles.

One-litre Florence flasks of pyrex glass, closed with rubber stoppers coated with lead foil, were used as fumigation chambers. Measured quantities of the compound to be tested were placed on a piece of filter paper cut as small as possible, the paper was suspended from the stopper inside the flask, and the compound was allowed to evaporate. After several different insects were used in preliminary tests, the house fly (*Musca domestica*) was selected. Five flies were put into each flask, the chemical introduced, and the flask tightly stoppered. When all the flies in the flask were apparently dead, they were removed to a vial and given 24 hours to revive. If none revived, the time during which the flies were exposed to the vapour was recorded. But, if the flies revived, the experiment was repeated. In each case 5 tests were made.

(1) See the *Journal of Economic Entomology*, Vol. IX, No. 1, pp. 71-80, 2 Figs., 1916. (Ed.)

Since similar weights of the different chemicals do not contain the same number of molecules, and their toxicity could not, therefore, be accurately compared, it was decided to determine the toxicity in minutes for similar fractions of a gram-molecule of each chemical. Different quantities of each chemical were tested and curves plotted. As the quantities increased, it was found that each chemical had a point beyond which an increase would not give a reduction in the time required to kill. This is the point at which the air is saturated with the vapour, and differs for each chemical. As the quantity is decreased, a point is reached where the vapour is not of sufficient strength to kill. The plotted curves lie between these two points.

After the curves were plotted, it was found to be impossible to compare similar fractions of a gram-molecule; hence, the different fractions of a gram-molecule necessary to kill in a fixed time of 400 minutes were determined. A long period of time was selected as a more nearly correct index of toxicity. The fraction of the gram-molecule was determined by dividing the amount of the chemical necessary to kill in 400 minutes, at a temperature of 70° F., by the molecular weight of the substance.

*Relation of the Volatility of Organic Compounds to their toxicity.*

Name of compound	Volatility in gram molecules evaporating in 400 minutes	Toxicity in millionths of a gram molecule killing in 400 minutes	Name of compound	Volatility in gram molecules evaporating in 400 minutes	Toxicity in millionths of a gram molecule killing in 400 minutes
Ethyl ether . . . . .	4.4245	4318.4	Amyl alcohol . . . . .	0.0460	38.2
Petroleum ether . . . . .	3.5841	713.3	Furfural . . . . .	0.0457	20.8
Ethyl mercaptan . . . . .	2.1541	109.9	Bromomethyl-phenylketone . . . . .	0.0282	2.4
Methyl alcohol . . . . .	1.9776	671.8	Butyric acid . . . . .	0.0241	25.8
Acetone . . . . .	1.3631	954.3	Ethyl aceto acetate . . . . .	0.0192	24.8
Carbon bisulphide . . . . .	1.3616	286.3	Amyl valerate . . . . .	0.0182	11.2
Chloroform . . . . .	1.2870	894.6	Valeric acid . . . . .	0.0113	15.3
Carbon tetrachloride . . . . .	0.7067	161.9	Allyl isosulphocyanate . . . . .	0.0085	1.2
Ethyl alcohol . . . . .	0.4342	331.2	Nitrobenzene . . . . .	0.0058	1.8
Benzene . . . . .	0.4097	142.3	Ethyl malonate . . . . .	0.0054	9.6
Chlorpicrin . . . . .	0.3243	1.7	Menthone . . . . .	0.0049	2.9
Acetic acid . . . . .	0.2936	60.0	Methyl salicylate . . . . .	0.0033	1.0
Thiophene . . . . .	0.2659	102.2	Camphene . . . . .	0.0032	44.0
Propyl acetate . . . . .	0.2610	103.4	Chloral hydrate . . . . .	0.0030	48.0
Acetaldehyde . . . . .	0.2343	273.2	Nanthalene . . . . .	0.0013	3.9
Toluene . . . . .	0.1918	147.5	Nicotine . . . . .	0.0010	2.4
Ethylene bromide . . . . .	0.1363	18.6	Camphor . . . . .	0.00068	5.2
Pyridine . . . . .	0.1347	21.7	Kerosene . . . . .	0.00067	11.9
Xylene . . . . .	0.1241	64.9	Chloretone . . . . .	0.0005	3.6
Amyl acetate . . . . .	0.0627	44.8	Menthol . . . . .	0.00019	3.2
Gasoline . . . . .	0.0520	42.0	Thymol . . . . .	0.00014	9.9
Amyl nitrite . . . . .	0.0512	41.1	Brometone . . . . .	0.00009	1.1
Bromoform . . . . .	0.0486	7.7			

All the benzene derivatives tested proved to be more toxic to insects, molecule for molecule, than carbon bisulphide.

Physical characters, such as boiling point and vapour pressure, have more influence on the toxicity than chemical composition.

Up to 250° C. the higher the boiling point the more toxic the compound to insects. Beyonds 250° C. the compound is usually so slightly volatile that not enough of the chemical will evaporate to be effective.

Lipoids are very soluble in compounds with low boiling points and but slightly soluble in compounds with high boiling points.

Compounds with low boiling points, although less toxic, owing to their great volatility, may give better results than compounds with high boiling points, particularly in the fumigation of grain.

The toxicity of the benzene derivatives was found to be similar for other insects. A comparison of the bluebottle fly (*Lucilia sericata*) with the house fly shows that house flies die more quickly from compounds with a low boiling point than bluebottle flies, while compounds with a high boiling point are more toxic to the bluebottle flies than to the house fly. Similarly, the cockroach (*Blatella germanica*) succumbs less readily than the potato beetle (*Leptinotarsa decemlineata*) to low boiling compounds and more readily to high boiling compounds. This relationship may be due to morphological differences in the insects, possibly the diameter of the spiracles or trachea.

For the fumigation of animals a compound with a high boiling point is needed in order that relatively little of the material shall be in the air to be taken in by the animal or to irritate the eyes or nose. In this respect salicylic aldehyde is probably the best. The cost of this chemical is prohibitive for general fumigation; but, inasmuch as higher animals readily oxidize it to salicylic acid, which is very slightly poisonous, this compound might be used for the internal fumigation of horses to destroy bots as carbon bisulphide is now used.

II. — Having pointed out the relationship between the toxicity of various benzene derivatives and their boiling points, the question arose whether a similar relationship of boiling point and toxicity existed among other-volatile organic compounds. Early in the work it was discovered that boiling point was merely a convenient general index of the volatility of the compound and that the real relationship was probably between toxicity and volatility. It was at first thought that this relationship existed only with compounds having an action on lower organisms similar to that of chloroform and ether, but it was soon found to have a wider range of application.

In general, the same methods were employed as in the previous work. The results are given in the table on p. 835 and summarised as follows:

In general, the toxicity of a volatile organic compound is correlated closely with its volatility. A decreasing volatility is accompanied by an increased toxicity. The boiling point of the chemical is a general index of its volatility. Compounds with boiling points of 225° to 250° C. are usually so slightly volatile that they do not produce death except after very long exposures. The structure of the respiratory system of the insect is probably

responsible for the remarkable influence of volatility on the toxicity of the vapour of volatile organic compounds.

**775 - Observations on the Immunity to Rinderpest of the Nellore (Indian) Cattle and of the Nellore-Native Grade Crosses, in the Philippines.**—YOUNGBERG, STANTON (Chief Veterinarian), in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 436-447, 6 Diagr., Bibliography of 6 Publications, Manila, 1917.

During the year 1909 the Philippine Bureau of Agriculture purchased 103 head of first-class Nellore cattle, with the purpose of ascertaining if these cattle could readily adapt themselves to local condition, and if they could be used to improve the native breeds of cattle. It was found that the Nellore cattle readily adapted themselves to the conditions in the lower altitudes of the Philippine Islands and that the crosses upon native and Chinese dams produced a very good type of animal.

Since 1909 further introductions of Nellore cattle have been made from time to time, and they are now being used to a great extent throughout the Islands for improving the native stock. The high resistance to rinderpest of the "plains" cattle of India has long been recognized (1). Coincident with the extended use of Nellore cattle for breeding purposes in the Philippines the idea became disseminated that the grades were very highly resistant to rinderpest and that by importing cattle of Indian breeds and crossing them upon the native stock the rinderpest problem would be solved. In view of this, the author decided to test the resistance of pure-bred Nellore cattle to the Philippine strain of rinderpest and also to make more careful tests and observations in regard to the resistance of the Nellore native grades. The results led to the following conclusions:—The pure Nellore cattle are very highly resistant to the Philippine strains of rinderpest, the mortality being insignificant. They are not, however, absolutely immune.

In the case of native cattle, the infectivity of the virus is not appreciably attenuated by being passed through Nellore cattle. This fact makes the latter very dangerous as conveyors of the disease, as they may react without showing clinical evidence.

The half-bred Nellore-native cattle do not inherit the high degree of resistance to rinderpest possessed by the Nellore stock. In infections of moderate virulence they apparently have somewhat greater resistance than the native animals, but in virulent infections this resistance does not afford them any protection.

(1) LINGARD, ALFRED (*Report on the Preparation of Rinderpest Protective Serum*, Calcutta, 1904, p. 8) states that "The cattle and buffaloes of the plains show varying degrees of immunity, so much so that especially in the United Provinces it would be impossible to utilize them for supplying virulent blood or for the purpose of testing the protective value of sera where a marked susceptibility is necessary in the animals utilized. Further it is well known that some plains animals in this country may pass through attacks of rinderpest of so slight a character, that it may even be overlooked by the initiated in this disease". He also ascertained that these plains cattle "require a dose (of serum) 15 to 18 times less than that required by the small hill animals per 600 pounds body weight". Similar statements have been made by HOLMES, J. D. E. (*Indian Civil Veterinary Department, Memoir No 3*, p. 127; *Memoirs of the Department of Agriculture in India, Veterinary Series*, Vol. II, No 2, p. 42). (Author)

From the inconclusive evidence at hand, the three-fourths Nellorenative grades appear to have a greater resistance than the native stock. The rinderpest problem of the Philippine Islands cannot be solved by the importation of Nellore or other Indian Cattle, unless possibly by carrying it out to the extent of practically eliminating the native stock.

776 - **Official Measures Adopted in the Argentine for the Control of the Tick Transmitting "Tristeza".** — *Anales de la Sociedad Rural Argentina*, Vol. LI, No 2, pp. 124-125. Buenos Aires, March-April, 1917.

The Argentine Government, acting upon the advice of the Ministry of Agriculture and upon information furnished by various agricultural societies, issued a decree in April, 1917, for the purposes of 1) calling attention to the losses caused by ticks, 2) pointing out the necessity for vigorous sanitary action, and 3) authorising the application of the measures suggested by a Commission appointed by the Ministry of Agriculture in October, 1916, if considered suitable by the Live Stock Department.

The decree defines the limits of certain areas as tick-free, intermediate or infested. Very strict rules are laid down regarding the movement of cattle from one area to another; these will be enforced two years after the date of the decree. Cattle may be moved from unclassified establishments only after preliminary dipping and then only within their own defined area. Official dipping tanks will be installed in the larger cattle markets and wherever considered necessary throughout the intermediate and infested areas. Corrals are to be set apart for the temporary housing of tick-free cattle journeying from the north. The best insecticides for tick eradication will be obtained and exact instructions issued for their application in varying proportions throughout the different seasons, as well as practical instructions for dipping. The biology of the tick (*Margaropus annulatus*) and methods for its destruction are to be studied under direction of the Ministry of Agriculture, and only competent inspectors will be chosen to superintend the dipping-tanks. All expenses in connection with tick treatment will be reduced to a minimum.

777 - **Pathogenic Action of Ixodids.** — PARODI, SILVIO E., in *Anales de la Sociedad Rural Argentina*, Vol. LI, No 2, pp. 111-124 + 4 Figs. Buenos Aires, March-April, 1917.

This paper is a review of the subject of tick-infestation, and gives an account of the various parasites transmitted by Ixodids and of their evolution in the tick and in the animal host. The method of transmission from tick to host is described. The ticks dealt with include *Margaropus annulatus*, which transmits *Piroplasma bigeminum* and *Anaplasma marginale* as well as *Theileria* and *Nuttallia* (these last two blood protozoa have not hitherto been observed in the Argentine). The author records his own experiences in the investigation of the evolution of the parasite in the tick.

In the tubes of the salivary glands and, more rarely, in the ovarian glands of the females of *M. annulatus* he found filiform forms of the parasite, which might be defined as sporozoites. In the stomach glands he found oval forms, besides other more or less spherical ones, which he identified as more

developed forms (sporoblasts) than the former, and, consequently, consecutive.

While studying the transmission of *Anaplasma* he came to the conclusion that *Stomoxys* and Tabanids do not transmit this disease. Healthy animals placed with those infected, but freed from ticks, remained uninfected although they were attacked by these flies.

In the case of natural or spontaneous anaplasmosis the disease is always preceded by piroplasmosis. Several authors, chiefly DESCAZEAU and PICCOLLO, maintain that the piroplasms, through the meganaplasms (spherical masses of chromatin 2 to 3  $\mu$  in diameter) phase change into anaplasms, and these in their turn may change into secondary piroplasms. The author inoculated a cow at the same time with *Piroplasma* and *Anaplasma*, and observed that the two parasites always preserve their characteristic morphological conformation.

778 — **Thyroid Hyperplasia and the Relation of Iodine to the Hairless Pig Malady** (1), — HART, E. B. and STEENBOCK, H., in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 2, pp. 313-323 + 2 Plates. Baltimore, Md., February, 1918.

The writers' experience with the hairless pig malady supports the view that it is occasioned by a low iodine assimilation by either intestine or thyroid, resulting in a goitrous condition in both mother and young. This condition interferes more severely with foetal development than with the normal maintenance of the mother. It appears to be produced by rations with high protein levels and low laxative effects, with the accompanying condition of lack of exercise and unclean surroundings. Young sows exposed to such conditions are more prone to develop thyroid enlargement than are mature sows. The authors recognize that there is the possibility that some rations from certain regions are naturally so low in iodine as to make the scarcity of iodine the direct cause. They have found it possible to grow sows to maturity on natural feeding materials grown in southern Wisconsin, but of relatively low protein content and good laxative properties, with the production of normal offspring. On the other hand, these same feeds combined in different proportions and fortified with protein concentrates lead to the production of hairless pigs.

The authors are of the opinion, for the present at least, that they have not reached the stage where it is wise to advocate the general use of iodine in the feed of all brood sows; that the conditions leading to the production of hairless pigs should first be analysed fully in order that we may acquire a complete understanding of the reasons for the successful rearing of sows intended for breeding purposes through the use of natural materials, unfortified with potassium iodide. However, in regions and on farms where hairless pig production is endemic or persistent in character the direct use of iodides should be made.

779 — **Poultry Parasites.** — HADLINGTON, J., in the *Agricultural Gazette of New South Wales*, Vol. XXVIII, No. 9, pp. 671-673. Sydney, September 3, 1917.

Vermin in poultry houses naturally fall into two groups: parasites that

(1) See also R. March 1918 No. 305. (Ed.)

live and hibernate in the poultry house on roofs, etc., such as *Dermanyssus gallinae* (red mite), and those which pass their whole existence on the fowl, such as *Goniocoles abdominalis* (large chicken louse). The latter may be combated with a dust bath, or by dusting the birds by hand with insecticides, or sulphur, or with equal parts of sulphur and fine ashes. The best method of keeping poultry houses free from vermin is to spray them with kerosene emulsion as often as necessary. The emulsion, which should be applied by a force pump so as to reach all the cracks and crevices, is composed of 8 oz. soft soap dissolved in 1 gal. boiling water, 1 gal. of kerosene being slowly added while stirring, and the whole thoroughly shaken to effect emulsification. For use, 10 gals. soft water must be added, and if the spray is to be also a disinfectant, one table spoonful of miscible carbolic acid to each gallon of emulsion should be stirred in. Where the infestation is severe, 2 or 3 applications may be necessary at intervals of 1 or 2 days.

**780 — Infections Caused by *Bacterium pullorum* in Adult Fowls (1).** — HADLEY, PHILIP, assisted by CALDWELL, D. W., ELKINS, M. W. and LAMBERT, D. J., in *Agricultural Experiment Station of the Rhode Island State College, Bulletin* 172, 40 pp., 11 Tables, Bibliography of 13 Publications. Kingston, R. I., November, 1917.

The present paper gives the results of a study in which it was established that *Bact. pullorum* Rettger was the causal agent in an epidemic in adult fowls indistinguishable in its clinical picture and pathological manifestations from fowl typhoid. The primary observations and the experimental features of the study lead to the conclusion that latent *Bact. pullorum* infection was stimulated into active manifestations of fatal generalised infection as a result of intestinal irritation, or other physiological changes, following the feeding of a ration containing a large proportion of roughage in the form of oat husks. The authors point out the need of regarding more seriously the *endogenous* as opposed to the *exogenous* origin of "epidemic" diseases among poultry. Among possible endogenous disease-stimuli the importance of a hygienic feeding diet is especially emphasized. The existence of intermediate bacterial forms, resembling *Bact. pullorum* but varying slightly toward *B. gallinarum* is suggested, and it is proposed to make use of the terms *Bact. pullorum* A. and *Bact. pullorum* B. in order to keep these types distinct pending their further study. It is further suggested that *Bact. pullorum* appears to stand as a border-line group in the colon-typhoid intermediates, separating the actual paratyphoids (*B. gallinarum*, etc.) from the actual paracolons (*B. suispestifer*, *B. paratyphosus* A and B, etc.).

ANATOMY  
AND  
PHYSIOLOGY :  
GENERALITIES

**781 — Studies in Calcium and Magnesium Metabolism.** — I. GIVENS, M. H. and MENDEL, LAFAYETTE B., The Effects of Base and Acid; II. GIVENS, M. H. The Effect of Diets Poor in Calcium; III. GIVENS, M. H., The Effect of Fat and Fatty Acid Derivatives. — *The Journal of Biological Chemistry*, Vol. XXXI, No 2, pp. 421-423, Bibliography of 19 Publications; pp. 435-439, Bibl. of 15 Public.; pp. 441-444, Bibl. of 6 Publ. Baltimore, Md., August 1917.

The work described was carried out at the Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven.

(1) See also R., Febr. 1918, No 180. (Ed.)



I. — The present investigation is primarily the outcome of a consideration of a claim of DUBOIS and STOLTE (*Jahrbuch für Kinderheilkunde*, Vol. LXXII, p. 21, 1913) that storage of calcium is dependent upon a suitable supply of alkali to the organism. By the addition of alkali carbonates to the food of children these investigators found that they could change a negative calcium balance to a positive one. They believed this outcome to be due to the neutralization, by the alkali, of the phosphoric and sulphuric acids formed in metabolism; also to a prevention of the formation in the alimentary canal of insoluble calcium soaps which cannot be utilized. According to the first consideration, by supplying alkali the unnecessary withdrawal of calcium as a neutralising agent for acids formed in metabolism is averted; and in the second instance the loss of unabsorbed calcium by the bowel is prevented.

The general plan of the studies of the authors involves metabolism experiments carried out with dogs, in which the income and outgo and the corresponding balance of various elements were ascertained under diverse conditions of diet. The results arrived at were as follows:—

Administration of base or acid produced no significant effect upon the balance of nitrogen, calcium, magnesium, and phosphorus in the dog.

Administration of hydrochloric acid increased the urinary excretion of calcium and thereby altered the relation of calcium to magnesium in the urine.

The calcium contained in milk was more effective than soluble calcium lactate in producing calcium retention.

Administration of large doses of alkali bicarbonate to a human diabetic did not decrease the urinary output of calcium.

II. — From a summary, given by the author in tabulated form, of all the available literature on the urinary alkali-earth excretion of *adult* dogs it is evident that there exists no *definite* relation between the diets and urinary calcium and magnesium. The tendency is for the excretion of these elements to increase as the intake of them increase.

From the literature on the subject we are led to conclude that a diet poor in calcium is not conducive to a storage of either calcium or magnesium, despite an abundance of nitrogenous food. This is further established by the author's investigations.

III. — The present conception of the digestion and utilisation of fats and other comparable esters of fatty acid would lead one to expect that if they are hydrolysed in the normally functioning alimentary tract the resulting fatty acid will either be absorbed promptly or excreted as insoluble soap with faeces. The extent to which absorption occurs may therefore depend not only upon the digestion of the esters but also upon the degree to which alkali earths are simultaneously present in the intestine to render the fatty acids insoluble and unutilizable. Conversely the loss of alkali earths through the bowel may likewise be promoted by the presence of large quantities of fatty acids. A study of the data here presented shows, with respect to the deportment of the calcium, that when the utilization is poor the loss of calcium is proportionate larger.

Similarly the negative calcium balance was smaller in those cases where the utilization of the fat was more satisfactory.

Although the quantity of calcium fed as calcium lactate in one of the periods was undoubtedly sufficient to induce a storage of lime on the basal diet this could not be accomplished when the fat utilisation was poor.

It is evident from the data presented that poor utilization of fats or fatty acids may increase the excretion of lime in the faeces and prevent the storage of calcium even when the calcium intake is comparatively abundant.

**782 — The Nutritive Properties of Maize (1).** — HOGAN, ALBERT A. (Department of Chemistry, Kansas State Agricultural Experiment Station, Manhattan, Kansas), in *The Journal of Biological Chemistry*, Vol. XXVII, No. 1, pp. 193-208, Bibliography of 21 Publications. Baltimore, Md., 1916.

The nutritive deficiencies of maize have been ascribed by the different investigators to : its lack of certain inorganic constituents ; protein deficiencies ; too small quantities of vitamins.

Most of the data described in this report were obtained by using albino rats as experimental animals. Some of them were given maize alone, others maize plus a salt mixture, a third lot maize plus an "ash-free" protein and a fourth maize plus "ash free" protein plus a salt mixture. The results are summarised as follows : —

The evidence indicates that when maize is fed to rats as the sole dietary the mineral constituents are the first limiting factor, and then the protein. In the case of swine these findings are apparently reversed. Protein is here the first limiting factor, and then the mineral element. The data also indicate that the maize proteins are less efficient for growth than casein. The addition of lysine and tryptophane to maize did not increase its efficiency for growth. The addition of some of the adequate proteins (egg white) seemed of only slight benefit. In view of these facts it seems possible that one of the limiting factors in maize as a food for growing rats is one or more of the growth accessories.

Young rats on a maize diet grow more rapidly when the grain is supplemented with casein than when supplemented with egg white. This observation assumes added significance since food mixtures containing protein-free milk, butter, and egg white are more efficient for growth than mixtures of maize and egg white, even though the protein of the maize mixture furnishes a relatively higher per cent of calories than does the protein of the more efficient diet.

Autoclaved maize mixtures failed to maintain body weight and ultimate failure resulted.

Since swine grow rapidly on a mixture of maize and egg white, it is believed that maize contains sufficient of the growth accessories for normal growth in swine.

(1) See also R. February 1918, No. 186. (Ed.)

783 - **Sudan Grass Silage.** — FRANCIS, C. K. and FRIEDEMANN, W. S., in the *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station Bulletin*, No. 115. Stillwater, Oklahoma, April 1917.

The department of chemistry of the Oklahoma Agricultural Experiment Station is engaged in investigating silage as prepared from the grain sorghums and closely related crops. A part of this experiment involves considerable work with sudan grass, and, owing to the apparent excellent quality of the silage, some of the results of this experiment have been published by the investigators in this bulletin. A steel silo 25 feet high and 9 feet wide, approximate capacity 75 tons, was used for curing the crop. The sudan grass was cut early in August during a dry period so that the plants did not contain as much moisture as desired. The sudan grass was cut to a three-quarter-inch length and a small stream of water was kept flowing into the blower, thus distributing the added water throughout the material as it was placed in the silo. During the filling of the silo the material was packed by three men tramping it into place as solidly as possible. The sudan grass owing to its leafy nature and dry condition did not pack readily. The day after the silo had been filled, water was added at the top until it ran out at the two-foot level. Three days later the contents of the silo had settled several inches and this place was filled with additional wetted silage to serve as cover. This material did not cure well, and was discarded when a strong mouldy condition developed, but the silage just beneath it cured nicely and retained its flavour throughout the feeding period. The composition of sudan grass silage as compared with maize silage is shown in Table I. The length of time which the material remained in the silo is indicated in the first column as days.

TABLE I, — *Percentage Composition of Sudan Grass Silage and Maize Silage (water-free basis).*

	Ash	Protein	Carbohydrates		Fat	Dry matter
			Fibre	N free extract		
Sudan grass silage fresh . . . . .	7.21	9.38	30.55	50.53	2.33	40.47
Maize silage fresh . . . . .	6.58	8.39	23.39	59.48	2.16	30.49
Sudan grass silage near top, 122 days . .	5.60	8.20	33.53	50.50	2.17	27.74
Maize silage near top, 148 days . . . .	6.81	9.56	23.62	57.41	2.60	27.75
Sudan grass silage from middle, 140 days	6.51	10.36	33.57	46.79	2.77	27.24
Sudan grass silage from middle, 182 days .	6.20	8.85	22.84	59.15	2.96	27.44
Sudan grass silage 2 feet above bottom, 281 days . . . . .	5.15	8.33	34.69	49.11	2.72	24.29
Spoiled sudan grass silage 2 foot-level, 192 days . . . . .	8.95	10.94	29.05	48.82	2.24	24.28

There is on the whole but little difference in the analyses of the maize silage and the sudan grass silage at the several stages of curing, the principal difference being in the quantity of fibre. The temperature developed in

the silo was noted at regular intervals until a decided fall was observed. From the data presented it appears that the maximum temperature was reached in about 21 to 30 days, being respectively 120° F. for the top portion, 104° F. for the middle portion, 21 feet from top, and 98.5° F. for the portion 5 feet from bottom.

The total quantity spoiled in this silo was approximately four feet, being the covering material. The sudan grass silage was somewhat bulkier than maize silage, was a light brown colour and had a faint acid odour. No alcohols were detected by the usual laboratory methods. The silage was fed to the College sheep, and, while proving a good feed, it did not appear to be relished by the animals so well as the maize silage, but quite as well as that made from other grain sorghums, and was relished much more in this form than as cured hay.

**784 - Nutrition Investigations upon Cottonseed Meal and Cottonseed Flour.** — RICHARDSON, ANNA E. and GREEN, HELEN S. (Nutrition Research Laboratory, Department of Domestic Economy, The University of Texas, Austin), in *The Journal of Biological Chemistry*. Vol. XXV, No 2, pp. 307-318, 5 Diagr. Baltimore, Md., June, 1916; Vol. XXX, No. 2, pp. 243-258, 13 Diagr. June, 1917; Vol. XXXI, No 2, pp. 379-388, 4 Diagr. August, 1917.

I. — In this paper the authors present a preliminary report on the efficiency of cottonseed meal as a food for promoting the growth, development and reproduction of the albino rat.

The results indicate that cottonseed meal does not contain sufficient mineral for growth, is not actively toxic, contains efficient protein, and perhaps fat-soluble growth-promoting substance, similar to those of butterfat, but in less adequate quantities.

II. — Albino rats have lived for 400 to 565 days with 50 per cent cottonseed flour in the diet.

The protein in a diet containing 50 per cent cottonseed flour, protein-free milk, and butter fat is sufficient for the normal growth and development of the albino rat and for reproduction to the third generation. No better growth is induced, but more frequent reproduction with lower mortality and more general well-being of animals are obtained, by the addition of 5 per cent casein to a diet containing 50 per cent cottonseed flour, butter fat, and protein-free milk.

Normal growth and reproduction do not result from diets containing 50 per cent cottonseed flour in which there is a lack of butter fat, protein-free milk, or both. However, 50 per cent cottonseed flour with 5 per cent casein and butter fat, without additional mineral beside that furnished by the cottonseed flour, supports normal growth and reproduction although the second generation does not grow quite normally on this diet.

No toxic effect is apparent in feeding from 45 to 50 per cent cottonseed flour to albino rats through four successive generations or during 565 days of the life of an individual. Petroleum-ether extract of the entire cottonseed fed in a well balanced diet has a depressing influence on the weight of the albino rat. Ethyl ether extract from petroleum-ether-extracted cottonseed and ethyl ether extract of Allison cottonseed flour have no harmful effect upon the albino rat.

III. — This paper considers the content in cottonseed flour of growth-essential factor other than protein and mineral, and reports the results of studies of the protein minimum of cottonseed flour. The results are summarised as follows: —

1) 20 per cent of the water extract of cottonseed flour dried on starch, equivalent per gm. to 2.5 gm. of cottonseed flour, *i. e.*, 50 per cent cottonseed flour in the diet, contains sufficient water-soluble food accessory for normal growth.

2) 4.35 per cent of the ether extract of cottonseed flour equivalent per gm. to 11.5 gm. of cottonseed flour, *i. e.*, 50 per cent cottonseed flour in the diet, does not contain sufficient fat-soluble food accessory for normal growth, but 12 per cent of the ether extract appears quite as efficient in supplying enough of the fat soluble accessory for normal growth as does an equivalent amount of butter fat.

3) 18 per cent cottonseed protein when supplied with adequate amounts of all other necessary nutritive factors induces practically normal growth of the male rat, and better than average growth in the female, and fairly normal reproduction, with high mortality and under size among the second generation.

4) 12 per cent cottonseed protein does not induce perfect growth.

Very little growth has been obtained with 6 per cent protein, the average gain in weight during 108 days being 8 to 9 gm. With only 4 per cent cottonseed protein rats have fallen off in weight when first placed upon this diet but have almost successfully maintained their weight for 50 days after.

785 - **Food Value of the Pea Nut (*Arachis hypogaea*)** (1). — DANIELS, AMY L. and LOUGHLIN, ROSEMARY (University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 2, pp. 295-301 + 3 Diagrams. Baltimore, February, 1918.

Up to the present the pea nut has been used chiefly as a cattle feed with such excellent results that the authors undertook a study to determine more exactly its food value. Feeding experiments on young rats showed the pea nut to be lacking in McCollum's fat-soluble food accessory. When 2% of butter fat was added to the ration the subjects improved, and with 5% showed absolutely normal appearance and development in every way. This, moreover, proves that the pea nut contains a sufficient quantity of McCollum's water soluble food accessory, as 56% of pea nut in the ration suffices to supply the necessary quantity of this accessory.

If the pea nut is compared with the soya bean (2) it is found to be poorer in mineral matter, especially in calcium, potassium, magnesium and sulphur. If a pea nut ration be completed by the minerals necessary to give it a mineral content equal to that of milk, which has been shown to be adequate for growing animals, a suitable food is obtained. Pea nut meal, which contains a large proportion of hulls, seems to contain sufficient mineral matter to maintain normal growth in young animals if 5% of butter fat be added.

In view of the large acreage suitable to the cultivation of the pea nut

(1) See also R. March, 1918, No 268 — (2) See R. January, 1918, No. 4. (Ed.)

and the fact that there is a tendency to use considerably more plant seeds in the diet, the authors do not hesitate to suggest the use of the pea nut as a human foodstuff. As in the case of the soya bean it is only necessary to add to it those elements in which it is lacking, *i. e.* certain inorganic material and the fat-soluble food accessory, to make it a complete food.

## HORSES

**786 — Potato Peelings and Heather as Coarse Fodder for Horses; Researches in Holland.**

— VAN DRIEST, P. A., in the *Tydschrift voor Diergeneeskunde*, Part 45, No. 10, pp. 286-288. The Hague, May, 1918.

**POTATO PEELINGS.** — According to the author, these constitute an excellent coarse feed for horses. Chemical analysis shows that washed and finely chopped peelings contain 12 % of starch, 1.27 % of albuminoids and 83.4 % of water. Although, according to SJOLLEMA the albuminoids in the peelings are of good feeding value and digestibility, the peelings are principally a starchy food.

As regards solanin, the author found that of 2 samples of peelings, one raw, the other having been boiled for 12 minutes, on analysis by the Meyer method the first was found to contain 80.4 % of water and 0.016 % of solanin, and the second, 90 % of water and 0.006 % of solanin. The increased water content, therefore, results in a reduced solanin content. Further the author has found that solanin is almost completely soluble in boiling water containing a very small amount of vinegar. Therefore, he advises, so as to avoid entirely the bad effect of solanin, that the peelings should be cooked for 10 to 15 minutes in water containing a little vinegar, then immediately removed as, on cooling, the solanin might be precipitated and be deposited again on the peelings.

Cooking the peelings has the advantage that their relatively high potash content, which is supposed to produce bad effects, is considerably reduced. In fact, the author found that a sample of raw peelings contained 1.14 % of ash, while after cooking there was only 0.58 %. As potassium compounds are mostly soluble, it may be admitted that in this way the greater part of the potassium is removed.

**HEATHER.** — To determine its feeding value, 2 pairs of draught horses were used that gave the same amount of work. The first team received each day 6.6 lb. of heather over and above the normal ration; the second team served as control. The animals were weighed every 2 days; the heather did not in any way influence the increase in live weight of the animals.

## CATTLE

**787 — A Study of the Rate and Economy of Gains of Fattening Steers.** — MUM-

FORD, H. W., GRINDLEY, H. S., EMMETT, A. D. and BULL, S., in *University of Illinois Agricultural Experiment Station, Bulletin* No. 197, pp. 567-604. Urbana, Illinois, March, 1917.

This bulletin is one of a series reporting the findings of an investigation in regard to the effect of variations in the amount and character of feed consumed upon the nutrition of two-year-old steers. It gives the results relating to the effect upon the rate and economy of gains: — 1) of variations in the amount of feed consumed ranging from maintenance to full feed rations; 2) of variations in the proportions of roughage and con-

centrates in the ration ; and 3) of the substitution of a nitrogenous concentrate for a part of the grain of a ration of clover hay and ground maize in the ratio of 1 to 5.

*The Experiment.* — Sixteen two-year-old, choice feeder steers were divided into 4 lots of 4 steers each. One lot was given a ration slightly above maintenance, another, an amount of feed equal to the maintenance ration plus one-third of the difference between the maintenance and the full-feed rations, another, an amount equal to the maintenance ration plus two-thirds of the difference between the maintenance and the full-feed rations, and another as much feed as the steers would eat readily.

The experiment lasted for 27 weeks and was divided into five test periods. The first period was 5 weeks in length, the second, third and fourth were each 6 weeks in length and the fifth was 4 weeks in length.

The feeds used were clover hay, ground maize, and linseed oil meal. The ration of the first test period consisted of clover hay and ground maize in the ratio of 1 : 1, that of the second, of clover hay and ground maize in the ratio of 1 : 3, that of the third, of clover hay and ground maize in the ratio of 1 : 5, and that of the fourth and fifth of clover hay, ground maize, and linseed oil meal in the ratio of 1 : 4 : 1.

In periods 1, 2, 3, 4, 5, the average daily gains of the different lots and the individual variations were as shown in Table I :

Lot		Average daily gains	Variations in daily gains
		lb.	lb.
Period 1	Maintenance . . . . .	1.46	0.34 - 1.97
	One-third-feed . . . . .	2.08	1.69 - 2.51
	Two-thirds-feed . . . . .	2.87	2.51 - 3.37
	Full-feed . . . . .	2.98	2.54 - 3.40
Period 2	Maintenance . . . . .	0.00	— 0.12 - 0.07
	One-third-feed . . . . .	1.64	1.31 - 1.98
	Two-thirds-feed . . . . .	1.84	1.57 - 2.24
	Full-feed . . . . .	2.28	1.95 - 2.62
Period 3	Maintenance . . . . .	0.04	— 0.12 - 0.14
	One-third-feed . . . . .	1.12	0.55 - 1.40
	Two-thirds-feed . . . . .	1.48	1.02 - 1.74
	Full-feed . . . . .	1.50	0.90 - 2.12
Period 4	Maintenance . . . . .	0.85	0.74 - 0.95
	One-third-feed . . . . .	1.65	1.36 - 2.17
	Two-thirds-feed . . . . .	2.14	1.74 - 3.07
	Full-feed . . . . .	2.45	1.81 - 2.86
Average of the 4 periods	Maintenance . . . . .	0.70	0.37 - 1.05
	One-third-feed . . . . .	1.32	1.23 - 1.39
	Two-thirds-feed . . . . .	1.79	1.75 - 1.81
	Full-feed . . . . .	2.13	1.98 - 2.29

The consumption of dry substance, digestible dry substance and net energy per pound of gain by one-third, two-third and full feed lots in the 5 periods was as shown in Table II.

Lot		Dry substance per lb. of gain		Digestible dry substance per lb. of gain		Net energy per lb. of gain	
		Average	Variation	Average	Variation	Average calories	Variation calories
		lb.	lb.	lb.	lb.	lb.	lb.
Period 1	One-third-feed . . .	6.61	5.35- 8.17	4.36	3.68- 5.38	4.12	3.50- 5.09
	Two-thirds-feed . .	6.25	5.37- 7.21	3.99	4.41- 4.63	3.76	3.21- 4.34
	Full-feed . . . . .	7.33	6.02- 8.71	4.59	3.82- 5.40	4.32	3.61- 5.06
Period 2	One-third-feed . . .	7.95	6.57-10.12	5.71	4.73- 7.20	5.90	4.88- 7.45
	Two-thirds-feed . .	9.96	7.78-11.85	6.85	5.40- 8.09	7.05	5.54- 8.33
	Full-feed . . . . .	9.86	8.27-12.06	6.36	5.35- 7.24	6.51	5.47- 7.40
Period 3	One-third-feed . . .	10.40	8.05-20.30	7.91	6.10-15.24	8.46	6.53-16.33
	Two-thirds-feed . .	11.08	9.70-16.47	8.15	7.14- 11.71	8.72	7.63-12.53
	Full-feed . . . . .	12.41	7.64-20.16	8.63	5.66-13.16	9.08	6.04-13.65
Period 4	One-third-feed . . .	6.81	5.18- 7.78	5.24	3.98- 6.04	5.53	4.20- 6.38
	Two-thirds-feed . .	7.06	5.11- 8.28	5.30	3.83- 6.22	5.58	4.04- 6.55
	Full-feed . . . . .	7.64	6.94- 8.22	5.79	5.50- 6.50	6.15	5.56- 6.87
Average of the 4 Periods	One-third-feed . .	9.51	9.17-10.04	6.96	6.73- 7.29	7.22	6.97- 7.55
	Two-thirds-feed . .	9.40	8.95- 9.64	6.67	6.48- 6.86	6.90	6.67- 7.10
	Full-feed . . . . .	9.63	8.41-10.47	6.60	5.95- 7.23	6.73	6.10- 7.48

From these results the following conclusions were drawn:—

Two-year-old steers may be maintained on 8 to 9 lb. of dry substance, 0.39 to 0.44 lb. of digestible crude protein and 6.5 to 6.8 calories of net energy per 1000 pounds live weight.

Fattening two-year-old steers may make satisfactory gains over a period of twenty-seven weeks on 14.3 to 22.1 lb. of dry substance, 0.72 to 1.44 lb. of digestible crude protein, and 11.9 to 13.0 calories of net energy per 1000 pounds live weight. Fairly good gains may be made even on less amounts than these.

The rate of gains of two-year-old steers depends upon the amount of feed consumed. However, the amount of feed consumed between one-third feed and full feed apparently has no effect upon the economy of gains as measured by the consumption of feed, of total dry substance, of digestible dry substance, and of net energy per pound of gain.

When a ration consisting of clover hay and ground maize in equal parts is changed to a ration consisting of one part of clover hay and three parts of corn, the amounts of digestible dry substance and net energy remaining practically unchanged, but the protein being reduced 10 to 12 per cent, the rate of gains and the economy of gains are considerably decreased. When a



ration consisting of one part of clover hay and three parts of ground maize is changed to one consisting of one part of clover hay and five parts of ground maize, the digestible dry substance, digestible protein and net energy also being slightly reduced, the rate and economy of gains are decreased.

The substitution of one part of linseed meal for one part of maize in a ration of clover hay one part and ground maize five parts, materially increases the rate of gains and the economy of gains. Steers which have been kept on a low plane of nutrition (maintenance) for a considerable time make more economical gains when put upon a full-feed ration than steers which have been upon full feed for some time. However, steers receiving more than a maintenance but less than a full-feed ration make no more economical gains when put upon full feed than steers which have already been on full feed.

From the results obtained in this investigation it seems safe to conclude that steers may be maintained or fattened with the ordinary rations of the corn belt on less digestible dry matter, on less digestible protein and on less net energy than the amounts prescribed by the generally accepted feeding standards.

**788 - Influence of the Age of the Cow on the Composition and Properties of Milk and Milk Fat.** — ECKLES, C. H. and PALMER, L. S. (Missouri Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 12, pp. 645-658. Washington, D. C., December 17, 1917.

The question of the changes in the composition of milk with successive lactation periods and particularly the question relative to the percentage of fat in the milk of the heifer has been of great practical importance to the dairyman, as a possible index of what may be expected from the mature animals. The conclusions so far reached from data compiled by several investigators have not been entirely uniform. This paper offers new data on the question, taken from the records of the University of Missouri dairy herd, composed of pure-bred animals of the Jersey, Holstein, Ayrshire and Short-horn breeds.

The data showing the average percentages of fat for the successive lactation periods of all animals of each breed and similar data for the entire herd are given in Table I. An examination of the record of the individual animals of each breed, showed rather striking differences among the breeds with respect to the frequency with which the individuals of each breed showed the highest fat test in each lactation period. This frequency calculated as the percentage of cows of each group showing the highest test for each period is presented for each breed in Table II which may be referred to as a frequency table.

These data show that the percentage of fat in the milk of Jersey cows attains its maximum with respect to the average for the entire lactation period during any one of the first three periods, but the chances appears to be greater that this will be attained in the second or third period rather than the first.

TABLE I. — *Percentage of fat in milk in successive lactation periods.*

Number of cows	Period											
	1	2	3	4	5	6	7	8	9	10	11	12
<i>Jersey</i>												
74	4.99	5.04	—	—	—	—	—	—	—	—	—	—
59	4.96	5.04	5.01	—	—	—	—	—	—	—	—	—
45	4.95	5.04	5.03	4.84	—	—	—	—	—	—	—	—
30	5.09	5.17	5.20	4.97	5.00	—	—	—	—	—	—	—
20	5.09	5.20	5.22	4.92	4.92	4.76	—	—	—	—	—	—
11	4.93	5.00	5.09	4.80	4.76	4.68	4.63	—	—	—	—	—
4	4.89	4.90	5.05	4.68	4.54	4.68	4.61	4.58	—	—	—	—
4	4.86	4.83	4.83	4.47	4.56	4.64	4.62	4.48	4.47	—	—	—
3	4.86	4.83	4.83	4.47	4.56	4.64	4.62	4.48	4.47	4.22	—	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	4.01
<i>Holstein</i>												
26	3.22	3.10	—	—	—	—	—	—	—	—	—	—
20	3.23	3.06	3.09	—	—	—	—	—	—	—	—	—
11	3.26	3.05	3.12	3.10	—	—	—	—	—	—	—	—
8	3.27	3.04	3.06	3.12	3.03	—	—	—	—	—	—	—
6	3.36	3.07	3.15	3.16	3.10	3.41	—	—	—	—	—	—
5	3.33	3.06	3.11	3.11	3.06	3.18	3.11	—	—	—	—	—
1	3.29	2.99	3.03	3.08	3.09	3.05	3.00	2.88	—	—	—	—
<i>Ayrshire</i>												
9	3.90	3.88	—	—	—	—	—	—	—	—	—	—
9	3.90	3.88	3.79	—	—	—	—	—	—	—	—	—
6	4.04	3.92	3.81	3.64	—	—	—	—	—	—	—	—
4	4.01	3.97	3.78	3.68	3.82	—	—	—	—	—	—	—
2	4.06	4.08	3.79	3.83	3.84	3.79	—	—	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	—	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	3.38	—	—	—	—
1	4.10	3.90	3.87	3.99	3.87	3.76	3.65	3.38	3.58	—	—	—
<i>All cows</i>												
109	4.48	4.48	—	—	—	—	—	—	—	—	—	—
88	4.45	4.47	4.45	—	—	—	—	—	—	—	—	—
62	4.56	4.58	4.58	4.41	—	—	—	—	—	—	—	—
42	4.64	4.65	4.66	4.49	4.51	—	—	—	—	—	—	—
28	4.65	4.66	4.67	4.47	4.45	4.36	—	—	—	—	—	—
17	4.42	4.36	4.44	4.25	4.21	4.18	4.13	—	—	—	—	—
6	4.46	4.42	4.52	4.30	4.19	4.26	4.14	4.10	—	—	—	—
4	4.67	4.60	4.59	4.35	4.44	4.42	4.38	4.21	4.25	—	—	—
3	4.86	4.83	4.83	4.47	4.56	4.64	4.62	4.48	4.47	4.22	—	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	—
2	4.99	4.90	4.75	4.50	4.44	4.76	4.70	4.48	4.49	4.33	4.22	4.01

TABLE II. — *Relative distribution of highest average test for the lactation period.*

Number of cows	Lactation periods	Proportion of cows showing highest test in period:						
		1	2	3	4	5	6	7

<i>Jersey</i>								
74	2	48.7	51.3	—	—	—	—	—
59	2	47.5	52.5	—	—	—	—	—
59	3	39.0	32.2	28.2	—	—	—	—
45	2	44.5	55.5	—	—	—	—	—
45	3	33.3	33.3	33.3	—	—	—	—
45	4	26.7	33.3	28.9	11.1	—	—	—
30	2	40.0	60.0	—	—	—	—	—
30	3	30.0	36.7	33.3	—	—	—	—
30	4	23.3	36.7	30.0	10.0	—	—	—
30	5	16.7	30.0	30.0	10.0	13.3	—	—
20	2	30.0	70.0	—	—	—	—	—
20	3	20.0	40.0	40.0	—	—	—	—
20	4	15.0	40.0	40.0	5.0	—	—	—
20	5	15.0	35.0	40.0	5.0	5.0	—	—
20	6	15.0	35.0	40.0	5.0	5.0	0.0	—
11	2	27.3	72.7	—	—	—	—	—
11	3	18.2	36.4	45.5	—	—	—	—
11	4	18.2	36.4	45.5	0.0	—	—	—
11	5	18.2	36.4	45.5	0.0	0.0	—	—
11	6	18.2	36.4	45.5	0.0	0.0	—	—
11	7	18.2	36.4	45.5	0.0	0.0	—	—

<i>Holstein</i>								
26	2	88.5	11.5	—	—	—	—	—
20	2	90.0	10.0	—	—	—	—	—
20	3	70.0	10.0	20.0	—	—	—	—
11	2	100.0	0.0	—	—	—	—	—
11	3	81.8	0.0	18.2	—	—	—	—
11	4	63.7	0.0	18.2	18.2	—	—	—
8	2	100.0	0.0	—	—	—	—	—
8	3	100.0	0.0	0.0	—	—	—	—
8	4	87.5	0.0	0.0	12.5	—	—	—
8	5	87.5	0.0	0.0	12.5	0.0	—	—
6	2	100.0	0.0	—	—	—	—	—
6	3	100.0	0.0	0.0	—	—	—	—
6	4	100.0	0.0	0.0	0.0	—	—	—
6	5	100.0	0.0	0.0	0.0	0.0	—	—
6	6	83.3	0.0	0.0	0.0	0.0	16.7	—
5	2	100.0	0.0	—	—	—	—	—
5	3	100.0	0.0	0.0	—	—	—	—
5	4	100.0	0.0	0.0	0.0	—	—	—
5	5	100.0	0.0	0.0	0.0	0.0	—	—
5	6	83.3	0.0	0.0	0.0	0.0	16.7	—
5	7	83.3	0.0	0.0	0.0	0.0	16.7	0.0

TABLE II (Continued)

Number of cows	Lactation periods	Proportion of cows showing highest test in period						
		1	2	3	4	5	6	7
Ayrshire								
9	2	55.5	44.5	—	—	—	—	—
9	2	66.7	33.3	—	—	—	—	—
9	3	55.5	22.2	22.3	—	—	—	—
6	2	83.3	16.7	—	—	—	—	—
6	3	83.3	16.7	0.0	—	—	—	—
6	4	83.3	16.7	0.0	0.0	—	—	—
4	2	75.0	25.0	—	—	—	—	—
4	3	75.0	25.0	0.0	—	—	—	—
4	4	75.0	25.0	0.0	0.0	—	—	—
4	5	50.0	25.0	0.0	25.0	—	—	—

Holstein cows on the contrary almost invariably show the highest average percentage of fat for the lactation period during the first period and the conclusion seems justified that this is a breed characteristic.

Ayrshire cows more frequently show a higher average lactation test during the first than during subsequent periods, but less frequently than in the case of Holstein cows.

The variations in the average percentage of fat among the first few lactation periods are not sufficiently great to be of much practical importance, but the gradual decline in average test accumulates to a figure of considerable importance as the number of lactation periods becomes greater.

The fact that certain of the animals of the Jersey and Holstein breeds whose records are included in the data, comprised an experiment to determine the influences of the plane of nutrition during growth and age of first calving upon the dairy qualities of cows, suggested that the two factors may have contributed to the difference in the character of the data from the two breeds.

The data concerning the influence of the plane of nutrition during growth, indicate that this factor may be of importance in connection with the average fat test for the first lactation period. The light-fed Jerseys showed both a lower average test in the first lactation period and also a less frequent tendency for this period to show the highest test, while the heavy fed Jerseys showed exactly opposite results. The strong breed tendency for the Holsteins to show a higher average test in the first lactation period than in any subsequent period was also materially diminished by light feeding during the growth of the animals.

It must also be considered that the light feeding of the animals for both breeds was by no means extreme, although it was widely different from the heavy feeding carried out with the other animals in the experiment.

The data bearing on the age of first parturition indicate that a difference of 16 months between the first parturition of the Jerseys had little influence upon the breed tendency already noted for the higher test to accompany the second lactation period. In the case of the Holsteins, however, calving at a more advanced age seemed to decrease the breed tendency for the first lactation period to show the higher average test. As far as the composition and properties of milk of aged cows is concerned neither the percentage composition of the milk nor the physical and chemical constants of the milk fat of aged cows show any abnormalities attributable to old age.

Butter made from the milk of a cow 19 years old and in her thirteenth lactation period was pronounced to be of excellent quality and kept for a period of three months at a temperature of 8° to 10° C, without showing any marked deterioration.

**789 - Researches on a New Galactagogue, in Italy.** — BRENTANA, D., in the *Rivista di Agricoltura*, Year XXIV, No. 18, pp. 141-142. Parma, May 3, 1918.

The author has studied the effect of injecting the animal with its own milk on the milk produced. The experiments were carried out on various cows and are still in progress. The results so far obtained appear to show that the injections really have an effect on the increase in milk yield of cows. The author, who will shortly deal with the matter more fully, presents the following note.

The best practical application of the method is to give a subcutaneous injection of 10 or 20 cc. of the cow's own milk every 10 or 20 days, commencing the tenth day after calving. The increase in milk production will be about 2 litres a day, and the composition of the milk will hardly vary. The technique of the method is very simple:—

1) Collecting 20-30 cc. of milk in a sterile recipient, after thoroughly cleansing the udder and the milker's hands.

2) Subcutaneous injection, under perfectly aseptic conditions, of 10-20 cc. in the cow from which the milk has been taken.

The author never had any trouble whatever with the injections that he made.

The treatment should be accompanied by adequate feeding for, if the udder can be stimulated, it is still necessary to provide the substances required for milk-formation.

**790 - Breeds of Dairy Cattle in the United States.** — DAVIS, H. P., in the *United States Department of Agriculture, Farmers' Bulletin 893*, pp. 1-36, Washington D. C., November, 1917.

In the United States five breeds of dairy cattle have attained considerable prominence, namely, the Ayrshire, Brown Swiss, Guernsey, Holstein-Friesian and Jersey. These breeds have been developed carefully for a considerable time for the purpose of dairy production and in consequence each transmits its characteristics with regularity to its offspring. Certain distinct features distinguish each breed from the others but all possess ability as milk producers.

**THE AYRSHIRE BREED.** — The first importation of Ayrshires in the

United States was made in 1822, since which time there have been frequent importations into both the United States and Canada. New England, New York and Pennsylvania probably contain the largest number of representatives of the breed. There is a small distribution in the middle Atlantic States and the Pacific Northwest. In Canada Ayrshires have had great popularity and the breed seems able to withstand the rigour of the Canadian climate. In weight the cows vary from 900 to 1300 pounds with an average for the United States of about 1000 pounds; bulls weigh between 1400 and 2090 pounds averaging about 1600 pounds.

Probably none of the other dairy breeds can compare with the Ayrshires in ability to obtain a livelihood on scanty pastures and this ability has made them very useful in sections where there is much rough land in pasture.

Ayrshire milk is only slightly coloured, and the fat is divided in uniformly small globules which on the average are smaller in size than those of any other breed.

The average of the 2598 cows that have completed yearly records for advanced registry to July 1, 1917, is 9555 lb. of milk testing 3.95 % butterfat; amounting to 377.51 lb. of fat.

The 10 highest producers of the breed for butterfat to July 1917 (the milk yields given first being for comparison only) were:— 1) Lily of Willowmoor (22269): 22 596 and 955.56 lb.; 2) Auchenbrain Brown Kate 4th (27943): 23 022 and 917.60 lb.; 3) Imp. Garclaugh May Mischief (27944): 25 329 and 894.91 lb.; 4) Auchenbrain Yellow Kate 3d (36910): 21 123 and 888.33 lb.; 5) Jean Armour 3d (32219): 21 938 and 859.65 lb.; 6) Agnes Wallace of Maple Grove (25171): 17 657 and 821.45 lb.; 7) Netherhall Brownie 9th (23985): 18 100 and 820.91 lb.; 8) Garclaugh Spottie (27 950): 22589 and 816.25 lb.; 9) Gerranton Dora 2d (23853): 21023 and 804.79 lb.; 10) Jean Armour (25487): 20 174 and 774.73 lb.; the *average* being 21356.1 lb. of milk and 855.4 lb. of butterfat

*Families.* On account of the comparatively recent origin of the breed few families have been developed. The more prominent in the United States are the Brownie, Auchenbrain, Finlayston, White Cloud, Jean Armour and Garclaugh May Mischief.

*Bulls.* The 10 Ayrshire bulls having the largest number of daughters with advanced-registry records to July 1917, are listed below, in Table I, together with the average production of their daughters.

The official organization of the Ayrshire breed in the United States is the Ayrshire Breeders' Association, with headquarters at Brandon, Vt. The secretary resides there and has charge of both registration and advanced registry work.

**THE BROWN SWISS BREED.** — The first importation of this breed into the United States was made in 1869 and comparatively few animals have since been brought into the country. The breed is not widely distributed in the United States being found principally in the States of New York and Wisconsin. The cows when mature weigh from 1100 to 1600 lb., with an average for the United States of about 1250 lb.; bulls range from 1500 to 2500 lb.

TABLE I. — *Ten Ayrshire bulls with largest number of advanced-registry daughters.*

Names	Number of daughters	Average pounds of milk	Average pounds of butterfat
g. Imp. Finlayston 882 . . . . .	78	10 513	431
2. Nox'emall 7312 . . . . .	79	9 646	367
7. Earl's Choice of Spring H.11 8 289 . . . . .	58	8 918	375
4. Imp. Morton Mains' Queechy 11 537 . . . . .	40	9 244	374
5. White Cloud of Hickory Island 10 377 . . . . .	36	11 133	435
6. Imp. Mooustone of Drumsnie 8 228 . . . . .	30	8 797	358
7. Imp. Holehouse White King 10 348 . . . . .	35	10 125	397
8. Imp. Howie's Dairy King 9 855 . . . . .	28	11 668	457
9. Benchan Peter Pan 12 971 . . . . .	27	11 414	438
10. Willowmoor Robin Hood 11 900 . . . . .	26	9 621	419

In disposition the cattle are mild and docile and for their size are very active; they are excellent grazers, especially on rough land.

In milk production this breed ranks well in the United States, with a moderate percentage of fat. The average of the 199 cows that have completed yearly records of production to June, 1917, is 10 868.7 lb. of milk testing 3.995 %, amounting to 433.45 lb. of butterfat.

The 10 highest butterfat producers of the breed (the milk yield given first being for comparison only) were:— 1) College Bravura 2d (2577): 19 460.6 and 798.16 lb.; 2) Ethel B. (3842): 18 816.2 and 779.97 lb.; 3) Rosalind B. (3905): 16 804.4 and 727.64 lb.; 4) Lola (3923): 16 844.6 and 685.47 lb.; 5) Edna C. 3d (5092): 16 496.7 and 669.35 lb.; 6) Lottie G. D. (3530): 17 595.3 and 664.25 lb.; 7) Brownie F: 17 420.8 and 662.25 lb.; 8) Kalliste W. (2905): 16 609.2 and 650.32 lb.; 9) Flora Duwire (4105): 16 538.1 and 649.42 lb.; 10) Nau of Lake View (4061): 17 136.4 and 647.30 lb.; the average yield being 170 65.6 and 683.72 lb. respectively.

*Families.* Families of Brown Swiss have not been developed to any great extent in the United States.

*Bulls.* Only few bulls have more than one daughter in the Register of Production; the 11 with the largest number of daughters to June, 1917, are: Mc Avoy, 2068; Zell, 2512; Reuben, 2927; Casper C., 1999; Ben Hanson, 2373; Collier, 2075; Junker, 2365; Mack IV., 2901; Meeta's Son, 1747; Richard Esmond, 1342; Speedwell, 2582. The official organization of the Brown Swiss breed in the United States is the Brown Swiss Cattle Breeders' Association and the secretary for both registration and Register of Production resides at Beloit, Wisc.

**THE GUERNSEY BREED.** — The first representatives of this breed were imported into the United States in the early part of the nineteenth century, but not until the last quarter of that period were efforts made to keep the breeding pure by the establishment of a herd register. Since that time there have been importations almost every year and the breed has grown

steadily in numbers and popularity. At present the largest numbers are found in the Eastern States, the Middle Western States coming next.

Guernseys are medium in size, varying in weight from 900 to 1400 lb., with an average for the United States of 1050 lb.; the bulls range from 1400 to 2200 lb., averaging about 1600 lb.

Guernseys possess a nervous disposition but are very quiet if properly handled.

Milk from Guernsey cows is noted for its extremely yellow colour and high percentage of butterfat. The fat globules are larger than those in milk from either Holstein or Ayrshire cows and consequently the cream rises more rapidly upon setting. The average of 6200 cows that have completed a year's record for the advanced Registry to August 15, 1917, is 8934.44 lb. of milk testing 4.99 %, amounting to 446.01 lb. of butterfat. The 10 highest butter-fat producers of the breed to August 1, 1917 (the milk yield given first being for comparison only), were:—1) Murne Cowau (19597): 24 008 and 1098.18 lb.; 2) May Rilma (22761): 19 673.0 and 1073.41 lb.; 3) Laugwater Hope (27 946): 19 882.0 and 1003.17 lb.; 4) Yeksa's Tops of Gold's Fannie (22362): 19 794.9 and 981.53 lb.; 5) Spotswood Daisy Pearl (17696): 18 602.8 and 957.38 lb.; 6) Julie at the Chêne (30460): 17 661.0 and 953.53 lb.; 7) Belladia (31909): 19 631.9 and 934.05 lb.; 8) Imp. Dairy Moon III (28471): 18 019.4 and 928.39 lb.; 9) Miranda of Mapleton (19606): 16 630.7 and 927.16 lb.; 10) Dairymaid of Pinchurst (24 656): 17285.3 and 910.67 lb.; the average yields being 19 118.9 and 976.75 lb. respectively.

*Families.* There are a number of well-developed families of Guernseys, of which the following are among the more widely known:—May Rose, Glenwood, Masher's Sequel, Governor of the Chêne, Yeksa, Tricksey, and Sheet Anchor.

*Bulls.* Some of the leading sires, with their advanced-registry progeny are given below in Table II. They are arranged according to the number of their advanced-registry daughters to May, 1916.

The official organization of the Guernsey breed in the United States is the American Guernsey Cattle Club, and the secretary for both registration and Advanced Registry resides at Peterboro, N. H.

**THE HOLSTEIN-FRIESIAN BREED.**—The Dutch settlers in the State of New York were probably the first to import individuals of the Holstein-Friesian breed, but the first importations of which records exist were made between 1857 and 1862 and many of the present day animals are descended from these importations.

Holsteins have grown greatly in numbers and popularity in recent years, owing in a great degree to the increased demands in large cities for market milk. Cattle of the breed are most numerous in the Eastern and Middle Atlantic States, with the Middle Western and Pacific sections next in order. With the exception of the Jersey, there are more Holstein cattle in the United States than of any other dairy breed. The Holstein is the largest of the dairy breeds of the United States. Cows at maturity vary in weight from 1100 to 1800 lb., with an average for the United States of about 1250 lb.; bulls range from 1500 to 2600 lb. averaging 1800 lb.



TABLE II — *Sixteen Guernsey bulls, with largest number of advanced-registry daughters.*

Names	Advanced registry daughters	Sons with one or more daughters in advanced registry
1. Masher's Sequel 11 462 . . . . .	63	20
2 Governor of the Chêne R. G. A. S. 1 297 P. S. . . .	52	20
3. Galaxy's Sequel 16 904 . . . . .	37	16
4. Masher, R. A. A. S. 63 F. S. . . . .	28	8
5. Cora's Governor, of the Chilmark 8 971 . . . . .	28	3
6. Glenwood Boy of Haddon 4 605 . . . . .	26	22
7. Glenwood's Main Stay 6 067 . . . . .	25	18
8. Lord Mar 14 357 . . . . .	25	3
9. Golden Noble 2d., R. G. A. S. 1 836 P. S. . . . .	24	4
10. Starlight's Excelsior 7 992 . . . . .	23	3
11. Princess's Jewel 24 877 . . . . .	23	1
12. King Ccral 5 238 . . . . .	22	1
13. Governor 1st of the Chêne 105 63 . . . . .	22	0
14. Glenwood's Champion 15 639 . . . . .	20	0
15. Justinée's Sequel of the Préel R. G. A. S. 2 119 P. S.	21	1
16. King of the May 9 001 . . . . .	17	9

In disposition Holsteins are docile and rather lazy in general habits as shown in their poor "rustling" ability in grazing scanty pastures. They are large consumers of feed, especially roughage, and do best when plenty is readily available. From the point of view of milk production Holsteins average higher than any other breed. The percentage of butterfat, however, which averages lower than that of any other dairy breed, tends to counterbalance the advantage of a greater production. The 3220 cows that have completed a yearly record for the Advanced Registry to February 19, 1917, averaged 14 622.7 lb. of milk testing 3.424% butterfat amounting to 500.7 lb. of fat.

The ten highest butterfat producers among Holsteins (the milk yield given first being for comparison only), were: — 1) Duchess Skylark Ormsby (124514): 27 761.7 and 1205.09 lb.; 2) Finderne Pride Johanna Rue (121083): 28 403.7 and 1176.47 lb.; 3) Finderne Holingen Fayne (114551): 24 612.8 and 1116.05 lb.; 4) Queen Piebe Mercedes (154610): 30 230.2 and 1111.56 lb.; 5) Ona Button De Kol (115939): 26 761.2 and 1076.44 lb.; 6) Maple Crest Pontiac Application (141158): 23 421.2 and 1075.44 lb.; 7) Banostine Piebe De Kol (90441): 27 404.4 and 1058.34 lb.; 8) Royalton De Kol Violet (86460): 29 949.6 and 1036.45 lb.; 9) Keystone Beauty Plum Johanna (161616): 25 787.5 and 1035.77 lb.; 10) Pontiac Clothilde De Kol 2d (6999r) 25 318.0 and 1017.28 lb.; the averages being 26 965.03 and 1090.98 lb. respectively.

*Families.* The families of the Holsteins are very numerous and it is difficult to determine which are the more important. Probably the following are among the more widely known: — Aaggie, Abbekerk, Artis, Beets,

Burke, Butter Boy, Carlotta, Clothilde Colantha, De Kol, Fayne, Gerben, Hartog, Hengerveld, Johanna, Korndyke, Mechthilde, Mercedes, Mutual, Netherland, Ormsby, Pietertje, Pietje, Pontiac, Sarcastic, Segis, Spofford, Vale, and Veeman.

*Bulls.* The bulls having the largest number of progeny with records, according to volume 27 of the Holstein-Friesian Blue Book, are listed below. (The records are for seven days).

TABLE III

	Number of tested daughters	Number of proved sons	Number of proved daughters
1. King of the Pontiacs 39 037 . . . . .	186	99	46
2. Pontiac Korndyke 25 982 . . . . .	135	69	66
3. Lord Netherland De Kol 22 187 . . . . .	125	37	140
4. De Kol 2d's Butter Boy 3d. 23 260 . . . . .	118	94	80
5. Hengerveld De Kol 23 102 . . . . .	116	65	84
6. Poul Beets De Kol 22 235 . . . . .	105	49	92
7. Homestead Girl De Kol Sarcastic Lad 32 558 . . . . .	105	38	56
8. Aaggie Corruccopia Johanna Lad 32 554 . . . . .	102	68	68
9. Colantha Johanna Lad 32 481 . . . . .	100	70	35
10. Pietertje Hengerveld's Count De Kol 23 224 . . . . .	99	56	65
11. Lilith Pauline De Kol's Count 28 430 . . . . .	93	55	67
12. Korndyke Queen De Kol's Count 28 430 . . . . .	88	17	47
13. King Segis 36 166 . . . . .	87	80	55
14. Mercedes Julip's Pietertje's Paul 29 830 . . . . .	84	35	49
15. Tity Abbekerk Prince 37 770 . . . . .	80	8	29

The Holstein-Friesian Association of America is the official organization of the breed in the United States with headquarters at Brattleboro, Vt. where the secretary resides. The headquarters of the Advanced-Registry work of the association is at Delavan, Wis.

**THE JERSEY BREED.** — Jerseys were first imported into the United States about the middle of the last century, and since that time importations have been made practically every year. The breed probably has the largest numbers and widest distribution of all the dairy breeds of the United States. Large numbers of Jerseys may be found throughout New England, the Middle West, the South and the Southwest. Jerseys are the smallest of the dairy breeds. Mature cows range from 700 to 1 300 lb., with an average for the United States of about 900 lb.; bulls vary from 1 400 to 2 000 lb. averaging 1500 lb.

Jerseys have a distinctly nervous disposition and are usually somewhat excitable. Their highly organized nervous system causes them to respond quickly to good treatment and abundant feed.

In natural yellow colour the milk of Jersey cows ranks next to that of Guernsey cows and is usually slightly richer in butterfat. The large fat globules cause the cream to rise readily upon standing. The average of

the 5 244 cows that have completed yearly records for the Register of Merit is 7 792 lb. of milk testing 5.35 %, making 417 lb. of butterfat.

The ten highest butterfat producers among Jerseys (the milk yields being given first for comparison only) were :—

1) Sophie 19th of Hood Farm (189748): 17 557.7 and 999.1 lb.; 2) Spermfield Owl's Eva (193934): 16 457.4 and 993.3 lb.; 3) Eminent's Bess (209719): 18 782.9 and 962.8 lb.; 4) Dosoris Park Lily (233783): 16 728.1 and 957.4 lb.; 5) Jacoba Irene (140443): 17 253.2 and 952.9 lb.; 6) St. Mawes Poppy (219992): 15 782.4 and 952.3 lb.; 7) Olympia's Fern (252060): 16 147.8 and 937.8 lb.; 8) Lass 66th of Hood Farm (271890): 17 793 and 910.6 lb.; 8) Lass 38th of Hood Farm (223628): 15 284 and 890.4 lb.; 10) Spermfield Owl's Temisia (215982): 15 147.1 and 875.2 lb., the averages being respectively 16693 and 943.1 lb.

*Families.* A considerable number of families have been developed and it is difficult to determine which are the most prominent, but probably the following are among the best known:— St Lambert, Rioter, Tormentor, Golden Lad, Flying Fox, St. Helier, Combination, Oxford, Financial King, Owl, Jacoba, St Mawes, Eminent, Diploma and Torono.

*Bulls.* Some of the Jersey bulls having the largest number of Register of Merit daughters to July, 1916, were:—

1) Hood-Farm Pogis 9th 55552 with 78; 2) Hood Farm Torono 60326 with 71; 3) Spermfield Owl 57088 with 48; 4) Loretta's King 65050 with 40; 5) Interested Prince 58 224 with 39; 6) Raleigh's Fairy Boy 83767 with 39; 7) Hector Marigold 59121 with 33; 8) Gomboge's Knight 95 698 with 33; 9) Noble of Oaklands 95700 with 33; 10) Saydus's Heir 45360 with 33; 11) Royal Majesty 79313 with 32.

The American Jersey Cattle Club is the official organization, with headquarters at 324 West Twenty-third Street, New York, N. Y., which is the address of the secretary for both registration and Register of Merit.

791.<sup>1</sup>— **Establishment and Management of the Dairy Farm in India.** — KULKAR, RAO BAHADUR G. K., in *Department of Agriculture, Bombay, Bulletin*. No. 86, pp. 1-60. Poona, 1917.

Since 1908, when a bulletin on the establishment and management of dairy farms was first published by the Department of Agriculture of the Bombay Presidency, the dairy industry has developed considerably all over India, and the Military Department especially has taken up this work very seriously and has opened dairies and dairy farms all over India with up-to-date equipment and machinery. Even with regard to the civil population the question of supplying good milk to cities and towns has come into great prominence at present. This bulletin has been therefore prepared as a guide for people intending to enter this new industry.

**THE DAIRY HERD.** — The common dairy breeds in the Bombay Presidency are :—

*Cows* : Aden, Sindhi or Karachi, Gir or Sorti, Kankrej and Krishna valley. The last two are also good work breeds.

*Buffaloes* : — Jafferabadi, Dehli, Surti or Nadiadi, Deccani, Varadi, and Nagpuri.

The following table will give an idea of the prices, live weight and average annual milk yields as compiled from the records of the Civil Dairy Kirkee:

TABLE I.

Name of Breed	Average price per head in Rs.	Average live weight in lb.	Average number of animals in the herd	Period under observation, years	Average annual yield per head in lb.
<i>Cows :</i>					
Aden . . . . .	75-100	500-600	5	12	1972
Sindhi . . . . .	125-150	650-750	26	12	2022
Gir . . . . .	75-100	700-800	9	10	1604
Kankrej . . . . .	75-100	700-850	—	—	—
Krishna Valley . . . . .	100-125	900-1000	—	—	—
<i>Buffaloes :</i>					
Jafferabadi . . . . .	120-175	1100-1300	11	10	2476
Dehli . . . . .	150-200	1000-1200	11	10	1858
Surti or Nadiadi . . . . .	125-150	900-1100	37	12	2161
Deccani . . . . .	75-100	600-750	6	8	1275
Varadi . . . . .	100-125	800-1000	—	—	—
Nagpuri . . . . .	100-125	800-1000	—	—	—
<i>Bulls :</i>					
Aden . . . . .	100-150	700-850	—	—	—
Sindhi . . . . .	150-200	1000-1100	—	—	—
Gir . . . . .	100-125	1100-1250	—	—	—
Kankrej . . . . .	175-200	1000-1250	—	—	—
Surti . . . . .	100-125	1000-1150	—	—	—
Dehli . . . . .	150-200	1000-1250	—	—	—

POSSIBILITIES OF IMPROVEMENT. — Although the average yield of the Sindhi cows and of the Surti and Delhi buffaloes is 2 022 lb. and 2 161 lb. respectively still there are individuals which give much higher yields than the average as shown by the milk records of the Civil Dairy Kirkee which are given in Table II.

TABLE II.

Name of animal	Name of breed	Years under observation	Average annual milk yield, lb.	Average annual yield of the whole herd of the breed, lb.
Cows :				
Zankar. . . . .	Sindhi	13	3413	2022
Chauguni. . . . .	»	5	3551	
Mohan. . . . .	»	9	2968	
Surti Buffaloes :				
Kaveri. . . . .	Surti	13	3095	2161
Sajani. . . . .	»	9	3526	
Lavangi. . . . .	»	7	3987	

There is a further possibility of improvement by crossing the Sindhi cows with an Ayrshire bull. The results obtained at the Military Dairy Farms, Southern Circle, are encouraging as will be seen from the yields of cows noted in Table III which have completed one lactation period :—

TABLE III. *Military Dairy Farm Kirkee.*

No. of cow	Cross	Average milk yield of the cross per period lb.	Average milk yield of dam lb.	No. of cow	Cross	Average milk yield of the cross per period lb.	Average milk yield of dam lb.
1	Ayrshire × Sindhi	4308	3229	9	Ayrshire × Sindhi	4934	2148
2	»	3450	3229	13	»	8506	2761
3	»	4503	2260	14	»	3547	1986
4	»	3364	2578	16	»	7500	3268
5	»	4367	1471	26	»	4575	2068
7	»	2170	1076	24	»	5200	1973
8	»	3311	1683	6	Ayrshire × Hansi	4798	2734
14	»	7310	2917	Average	»	4789.5	2358.7

Table IV shows the average analyses of average samples of milk from 9 Sindhi cows and 27 buffaloes milked at the Agricultural College Dairy, Kirkee, between 2 and 4 a. m. in the morning and 12 and 2 in the afternoon.

TABLE IV.

		9 Sindhi cows		Buffaloes herd (27 head)	
		Morning milk	Evening milk	Morning milk	Evening milk
<i>Constituents :</i>					
Water	% . . . . .	86.75	85.91	82.99	81.92
Fat	" . . . . .	4.29	5.42	7.92	8.10
Casein	" . . . . .	3.12	2.95	3.98	4.02
Milk sugar	" . . . . .	5.28	5.40	4.98	5.39
Ash	" . . . . .	0.70	0.69	0.78	0.80

The relative proportion by weight of butter fat to milk in the average daily yield of Sindhi cows and of the whole buffalo herd is shown in Table V.

TABLE V.

Description of animal	Average quantity of milk per head in one day		Average quantity of butter fat per head in one day		Remarks
	lb.	oz.	lb.	oz.	
Cows (Sind) . . . . .	13	14	—	9.87	1 lb. butter from 22 lb. milk
Buffaloes . . . . .	9	2	—	14.37	1 lb. butter from 11 lb. milk

Approximately 1 lb. of cream is obtained from 6 to 8 lb. of buffalo's milk and from 10 to 12 lb. of cow's milk and 1 lb. of butter is obtained from 12 to 14 lb. of buffalo's milk and from 20 to 24 lb. of cow's milk. This standard is, however, found to vary month by month, as will be seen from the figures given in Table VI.

TABLE VI. — *Average number of pounds of buffalo's milk required to make a pound of butter during each month in the year.*

Month	Milk in lb.	Month	Milk in lb.	Month	Milk in lb.
April . . . . .	9.9	August . . . . .	12.1	December . . . . .	11.0
May . . . . .	9.9	September . . . . .	12.2	January . . . . .	11.1
June . . . . .	11.6	October . . . . .	12.1	February . . . . .	10.2
July . . . . .	11.8	November . . . . .	11.0	March . . . . .	10.9

According to Indian processes 15 to 18 lb. of buffalo milk are required to produce one pound of home-made buffalo butter, containing 17.45 % moisture, 81.61 % fat, 0.86 % casein and 0.08 % ash. This butter yields about 80% of "ghee", or clarified butter, obtained by evaporating the water by boiling it on a low fire for about 30 minutes; "Ghee" from fresh buffalo butter can be kept for about 2 to 3 months without any deterioration.

In outlying villages in India, where there is no demand for milk, or "ghee", desiccated milk called "Khawa" is prepared from whole milk from which cream is partially removed by setting it in shallow pans. The milk is boiled in large open vessels, until most of the water is driven off. When the mass is sufficiently thick, it is allowed to cool and is made into balls and sent out to "Halwais" (confectioners) who mix Khawa with fine sugar and turn it into "pedhas" and "burphi" which are the favourite sweetmeats of the Indians.

"Khawa" is also made from separated milk in North Guzerath. About 12 lb. of milk is required to produce one pound of "khawa", but when the whole milk is fresh and unadulterated it takes only 4 lb. to produce one pound of "Khawa".

The business aspect of the dairy industry is discussed by the writers in detail under the following headings: Equipment, machinery and other dead stock, management and labour, dairy buildings, scheme for continuous supply of green fodder, recurring annual expenses, recurring expenditure on feed and maintenance of live stock, and record sheets to be kept on a dairy farm of 200 head of cattle.

792 — Testing of Purebred Dairy Cows in New Zealand. — SINGLETON, W. M., in *The Journal of Agriculture*, Vol. XVI, No 2, pp. 63-75. Wellington, February 20, 1918.

The support accorded by the breeders of purebred dairy cattle in New Zealand to the certificate-of-record testing system, during recent

years evidences an effort that will produce a marked influence on the economic position of the dairy industry in New Zealand.

The following table shows the number of certificates issued during each calendar year since the inception of the system.

Breed	1913	1914		1915		1916		1917	
		Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat	Ordinary	Repeat
Jersey . . . . .	67	104	14	91	3	94	11	94	12
Friesian. . . . .	48	67	11	62	9	44	5	62	14
Ayrshire . . . . .	—	17	1	12	1	9	—	4	3
Shorthorn. . . . .	—	—	—	2	—	7	—	21	—
Totals . . . . .	115	188	26	167	13	154	16	181	30

The number of breeders now testing cows shows an increase of 20 per cent over the number testing a year since, and with sufficient testing staff could have been increased to 25 per cent.

The work is destined to make rapid growth in New Zealand, with the coming of normal conditions.

Not a sufficient proportion of the breeders are yet possessed of a due appreciation of the work, and not a sufficient percentage of the dairy herds are yet headed by a purebred butter-fat-record dairy bull. The growth of dairy husbandry in New Zealand, however, suggests that for many years to come the scope for this work will be unlimited. During the year 1917 certificates have been issued for eight Friesian records of production exceeding 600 lb. of butter fat. Three of the class-averages show an increase over the preceding season. The complete figures for 1917 are as follows:—

Class	No. of cows	Average yield for Season		
		Days in milk	Milk	Fat
			lb.	lb.
Junior two-year-old . . . . .	12	346	9 887.60	353.73
Senior two-year-old . . . . .	11	323	9 655.90	326.08
Junior three-year-old . . . . .	4	361	12 797.10	455.98
Senior three-year-old . . . . .	4	343	13 711.84	480.37
Junior four-year-old . . . . .	9	353	13 615.90	475.72
Senior four-year-old . . . . .	6	359	17 250.00	601.57
Mature . . . . .	30	333	14 123.04	495.08

The class production average for the Jersey breed in 1917 was as follows:—

Class	No. of cows	Average yield for Season		
		Days in milk	Milk	Fat
			lb.	lb.
Junior two-year-old . . . . .	39	345	6 429.10	360.62
Senior two-year-old . . . . .	9	323	5 912.40	318.82
All two year-old. . . . .	48	340	6 123.90	352.70
Three-year-old. . . . .	19	328	7 176.40	398.21
Four-year-old . . . . .	9	340	7 926.60	410.53
Mature class . . . . .	31	347	8 454.99	460.92

The Ayrshire class leaders for 1917 were as follows : —

Class	Age at testing	Fat required for certificate	Yield for Season			
			Days	Milk	Fat	
	Years		days	lb.		lb.
Two-year-old . . . . .	2	348	275.3	365	12 583.00	502.55
Three-year-old . . . . .	3	321	309.1	365	11 604.20	426.68
Four-year-old . . . . .	4	348	348.3	365	14 348.60	591.16
Mature . . . . .	6	354	350.0	365	14 636.00	582.47

The work connected with the C. O. R. testing has been much decreased by the cooperation of the secretaries of the several breeders' associations.

**793 — Development of Cow-Testing Associations in the United-States.** — *The United States Department of Agriculture Weekly News Letter*, Vol. V, No. 24, p. 5. Washington, D. C., January 16, 1918.

Cow-testing associations, as a result of work by the Bureau of Animal Industry of the U. S. Department of Agriculture, have continued to increase until there are now 472 active associations composed of 12 088 dairymen, owning 216 831 cows. The past year showed a gain of 37 per cent in number of associations. The cows tested constitute almost 1 per cent. of all the dairy cows in the United States, the total number of milk cows on January 1, 1918, being in round figures 23 284 000. The most noticeable development of cow-testing associations has been in the Western States.

**794 — Goat Milk Records of the New York Agricultural Experiment Station.** — JORDAN, W. H. and SMITH, G. A., in *New York Agricultural Experiment Station Bulletin* No. 429, pp. 1-20. New York, 1917.

For three years an accurate record was kept, at the New York Agricultural Experiment Station, of the individual milk production of the animals included in the herd of milk goats; the cost of maintenance was determined, as well as the cost of milk and the composition of the milk.

The quantity of food consumed by 31 adult and 9 partially grown ani-



mals during the third year was as follows: Dry coarse food 37 740 lb.; Beets, 1 550 lb.; Cut grass, 24 000 lb.; Pasture, 132 days; Grain, 14 688 lb.

The total cost of this food at the prices then ruling was \$ 441.95. The average cost per month per goat varied from \$ 0.481 to \$ 0.992. The average cost of food per goat per year was \$ 11.05 making the daily cost \$ 0.03.

The average yearly yield for 10 animals during 3 years, including 28 lactation periods was 800.4 pounds.

The food cost of the milk per goat for all the goats during the third year was 4 cents per quart, and, for the three years during which the record was kept, 3.4 cents. The lowest cost was with the Saanen goat No. 11, for the second year, which was estimated to be 1.27 cents per quart. The other items of cost, such as care and overhead charges, it is not possible to give with any accuracy. The average food cost for a quart of milk from the Station herd of 25 Jerseys during the three years has been found to be 0.92 cents per quart.

The range of composition of the mixed milk of the whole flock as determined during the third summer was as follows: solids, 11.4 % to 11.9 %; solids not fat, 7.72 % to 8.61 %; fat 3.5 % to 3.8 %.

The composition of milk from individual goats was found to vary in total solids from 9.22 % to 18.55 %; in protein from 2.24 % to 4.96 %; in casein from 1.56 % to 4.6 %; in fat from 1.08 % to 8.4 %; and in ash from 0.43 % to 0.8 %.

A chemical study of goat's milk indicated no essential difference between the constitution of its casein and that of cow's milk. Marked and probably important differences were observed in the salts of the ash as compared with the ash of both cow's milk and human milk.

**795 — Breeds of Pigs in Brazil.** — HUNNICUTT, B. H., in *Chacaras e Quintaes*, Vol. XVII, No. 3, pp. 183-184, 1 Fig. São Paulo, March, 1917.

The native pigs of Brazil are, generally speaking, very good animals. They form more or less fixed types, usually considered as breeds, although they lack certain qualities necessary for this. The chief are:— "Canastrão"; "Canastra"; "Canastrinho" or "Tatù"; "Crioulo". The first three types, which are large, medium and small respectively, are fine fat producers. As they are not pure breeds, they lack fixed characters, and in addition, have the defect of being slow to arrive at maturity.

Foreign breeds have been tried in Brazil, with the results given below.

**Yorkshire**:— very susceptible to skin diseases and suffers from the great heat.

**Tamworth**:— being more suited for meat than lard production, which is the chief aim in Brazil, it cannot be bred on a large scale.

**Berkshire**:— seems suitable for Brazil, but has two serious disadvantages: it easily degenerates and the progeny of crosses with it lack stability.

**Poland China**:— fattens easily, docile temperament, gives good crosses which are not very prolific, lacks hardiness and easily degenerates.

**Large Black**:— suitable for small scale rearing, seems on the contrary to be little suited for large-scale rearing under Brazilian conditions.

PIGS

*Mule foot* ("Casco de burro") :— the statement that it does not suffer from disease appears unjustified.

*Duroc-Jersey* :— large, giving much fat and good meat, very fertile, hardy, good for crossing with native animals, fairly early-maturing.

Systematic selection is indispensable for the creation of a fixed national breed ; but the breeder has, in crossing with improved foreign pure breeds a much surer and more rapid method for increasing and improving the production of butcher's animals.

## POULTRY

**796 — A Study of the Effect of Cottonseed Meal versus Beef Scrap Upon the Egg Production, Fertility and Vitality of Poultry.** — AHRENS, B. A., in *Oklahoma Agricultural and Mechanical College, Agricultural Experiment Station, Stillwater, Bulletin No. 112*, pp. 20 + 21 Tables. Stillwater, January, 1917.

The object of these experiments was to determine the value of cottonseed meal as a feed for egg production when compared with beef scrap, and to determine also the effect of cottonseed meal in moderate as well as in excessive quantities upon the fertility and hatchability of eggs. The discussion of the data from these experiments is divided into two parts: Part I contains all data relating to the breeding; Part II contains data which show the value of the protein from the two sources as a factor in egg production. The conclusions arrived at are as follows :—

1) Cottonseed meal fed in combination with other feeds to form a proper nutritive ratio, or even when fed in excess, does not lower the fertility of domestic fowls, but in many cases the fertility was higher than when beef scrap or animal protein was used.

2) The percentage of fertile eggs hatched shows greatly in favour of cottonseed meal when compared with beef scrap if fed in a properly balanced ration, but when fed in excess gives rather poor hatching results.

3) The percentage of all eggs hatched also shows in favour of cottonseed meal compared with beef scrap when fed in a properly balanced ration, but when fed in excess the results are very poor.

4. As a feed for production of eggs only, and not considering effect on hatchability, beef scrap is superior to cottonseed meal, and more than makes up for its greater cost by apparently causing greater production.

5). The mortality of chicks was a great deal higher in pens fed cottonseed meal, both the normal and excessive ration.

**797 — Capons and Caponizing.** — SLOCUM, R. B., in *U. S. Dept. of Agriculture, Farmer's Bulletin 840*, pp. 15, 10 Fig., Revised Edition. Washington, December, 1917.

A bulletin for the use of poultry-farmers.

Large breeds, such as the Plymouth Rocks, Light Brahmas, Cochins, Indian Games, Langshans, Wyandottes, Orpingtons, and various crosses of these make the best capons. Cockerels should be caponized when they weigh from 1 ½ to 2 ½ lb. or when from 2 to 4 months old. The capons should be sold when 10 months old.

**798 - The Second Rearing of Silkworms in Italy, during Summer and Autumn, 1917.**

— CASELLA, L. G., in *Informazioni Seriche*, Year V, No. 2, pp 19-20. Rome, January 20, 1918.

The propaganda work for the second rearing of silkworms was helped in 1917 by the sale prices for the spring season, as well as by the quantity of unutilised mulberry leaves.

The amount of seed used for that rearing was certainly more than 15 000 ounces of 30 gm., since in Piedmont alone from 8 000 to 10 000 were hatched.

To ascertain the work done in each district by the competent institutions and the rearers, the Minister for Agriculture, who had distributed 1103 ounces of eggs hatching out of season and 463 ounces of eggs preserved by the embryostatic method, distributed a circular accompanied by a number of questions to be answered. The reports received by the Ministry of Agriculture, the most interesting of which were those of the "Associazione serica" of Piedmont, the "R. Scuola di setificio" of Como, the "Comitato per l'incremento della bachicoltura" of Milan, and of the "R. Osservatorio bacologico" of Cosenza, were examined to obtain the conclusions of greatest interest regarding the second rearing.

These reports show that with suitable climatic conditions and where the second rearings were suitably attended to, the rearings were quite advantageous. The cocoons were considered excellent, and were mostly sold at prices above 9 fr. the kg., even 15 fr. in Piedmont, and with a general average of 12.21 fr.

There were yields higher than 40 kg. per ounce, some even reaching 60 kg. On the other hand, under not very favourable conditions many rearings gave limited yields, some even proving failures.

The period indicated as being most suitable, begins at the end of August, and varies according to local conditions.

The studies and experiments on the most suitable varieties of eggs to use should be continued, and a more thorough preparation of the eggs should be encouraged by giving premiums to those who are successful. Intensive propaganda work should be carried out to spread good systems of rearing, and thus decrease the number of failures.

**799 - Sericulture in Cyprus.** — *The Cyprus Agricultural Journal*, Vol. XIII, Part. I, pp. 16-19. Nicosia, January, 1918.

During 1916-1917, the sericultural stations of Nicosia, Paphos, Vialoussa, Lapithos, and Morphon were very active. In these stations the new Cypriot race produced by the cross Japanese X Bagdad was reared, in order to fix and improve it. The breed showed improvement when compared with that of the previous year. The following results were obtained at the Nicosia Station; — *length of cocoon*: minimum = 39 mm, maximum = 44 mm.; *width of cocoon*: min. = 20 mm., max. = 22 mm.; *weight* = 3.07 gm. One ounce of seed produced 39.6 kg of cocoons. To obtain 1 kg. of raw silk 10.02 kg. of cocoons are required.

## FISH CULTURE

800 — **The Problem of the Restocking of the Alpine Lakes.** — GALLI-VALERIO, B., in the *Bulletin Suisse de Pêche et Pisciculture*, Year XIX, No. 2, pp. 18-21. Neuchâtel, February, 1918.

The restocking of the alpine lakes with fish is of considerable economic importance, especially in Switzerland on account of their large number (615 in the canton of Grisons alone). All those that are sufficiently deep are suitable for stocking with trout, as the water does not freeze down to the bottom. Nearly all are of this type, since the thickness of the ice in the alpine lakes does not exceed 32 in. The altitude is of little importance, as lakes over 6500 ft. are well stocked with trout, but on the contrary, the food question is very important. The researches carried out by PERO (*Nuova Notarisia*, 1893, pp. 3 and 47; 1894, p. 135) in the Valteline showed that algae, crustacea, insects, molluscs, and often small fish such as the minnow (*Phoxinus laevis*), are abundant in the lakes of that region and provide the conditions required for feeding trout.

The pests affecting pisciculture in that region are chiefly the otter, a rare animal, the water-shrew (*Crossopus jodiens*), the water-rat (*Arvicola amphibius*), a fish, the bull-head (*Cottus gobius*), that lives in lakes even above 6500 feet, and which devours large quantities of trout-eggs. But according to the author's observations, the greatest enemies of restocking the alpine lakes are the trout themselves, when they have grown too big, for they eat the fry and small trout.

As regards the species to choose for restocking, the author rejects *Trutta lacustris*, because it has the disadvantage that one or two individuals grow more than the others and destroy all the rest. The author tried *T. jario* from the Adda and its tributaries in the Publino Valteline lake, at 6500 ft., but found it had the same disadvantage as the previous species.

For restocking alpine lakes, a breed of *T. jario* should be used that has been bred in those lakes for generations, and which almost constitutes a distinct breed, characterised as it is by an almost black body, with brilliant red dots, almost orange flesh, and which always remains small (7 to 8 in.) so that there is no risk of one or two developing greatly, followed by the destruction of all the others. As the salmon (*Salmo salvelinus*) also occurs in certain alpine lakes, especially in the Tyrol, the author stocked lake Venina, Valteline (6022 ft.), with it, and obtained excellent results. Up to the present the lakes of the Swiss alps have been chiefly stocked with *S. irideus*.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

801 — **State Motoreculture in France and Italy.** — I. *Journal Officiel de la République Française*, Year XLIX, No. 312, pp. 9207-9214, 6 Tables. Paris, November 17, 1917. — II. *Le Génie Rural*, Year X, No. 78, pp. 10-12, 1 Table. Paris, 1917. — III. MAROZZI, ANTONIO, in *L'Industria*, Vol. XXXII, No. 2, pp. 37-39, 2 Figs. Milan, January 31, 1918.

I. — The French "Journal officiel" publishes the report on the Cultivation Department ("Service de la mise en culture des terres") created by the law of January 2, 1917 and in virtue of the decree of April 7, 1917,

which defines the functions of the department, specially as regards carrying out and superintending cultivation work, the purchase and upkeep of teams of tractors.

TABLE I. — *Financial Statement of the Service (in francs).*

Teams	Name and number of tractors	Staff and various	Fuel	Subsidy of the auto- mobile service(?)	Spare parts	No. of hectares worked	Cost price	Gener- al ex- penses	Total cost price
3	10 Mogul 12-25 HP.	16 975.69	29 512.69	1 800	4 728.00	656	81	4	85
4	10 Emerson. . . .	18 148.79	28 778.54	1 800	3 017.85	182	251	14	265
5	10 Case . . . .	14 002.64	18 206.18	1 800	1 656.00	292	122	8	130
7	10 Mogul 16 HP.	17 204.39	20 508.57	1 800	4 094.60	655	66	4	72
8	10 Emerson. . . .	19 000.80	27 878.65	1 800	8 018.00	812	69	3	72
9	10 Mogul 8-16 HP.	18 395.30	18 401.56	1 800	2 377.00	316	129	8	137
10	10 Mogul 8-16 HP.	19 273.00	28 022.78	1 800	4 189.80	740	72	3	75
11	10 Emerson. . . .	15 465.17	12 259.30	1 800	748.50	262	116	9	123
12	10 Emerson. . . .	18 021.95	22 941.43	1 800	6 898.40	518	95	5	100
13	10 Emerson. . . .	14 367.11	17 447.03	1 800	2 928.95	275	132	9	141
14	10 Emerson. . . .	15 713.36	19 736.64	1 800	1 240.00	408	93	6	99
15	10 Emerson. . . .	14 545.00	26 164.00	1 800	848.50	401	108	6	114
17	10 Emerson. . . .	19 648.10	27 147.73	1 800	13 543.65	548	113	5	116
18	4 Mogul 8-16 HP. and 6 Emerson	15 426.95	12 856.30	1 800	6 044.30	145	249	18	267
19	10 Emerson. . . .	16 190.40	14 270.45	1 800	1 685.00	273	124	8	132
20	10 Emerson. . . .	18 434.67	25 354.79	1 800	3 944.00	516	96	5	101
21	10 Emerson. . . .	14 808.70	12 712.50	1 800	2 508.00	263	121	9	130
22	10 Case 12-25 HP.	17 000.85	21 043.96	1 800	882.50	379	107	7	114
23	2 Fowler sets . . .	12 819.61	8 277.32	Depreciation of the material 11 850	—	473	69	5	74
25	10 Case 12-25 HP.	21 848.13	47 509.89	1 800	2 881.00	1 198	61	2	63
26	10 Case 12-25 HP.	16 324.60	38 406.35	1 800	723.50	642	89	4	93
27	10 Case 12-25 HP.	17 082.65	30 023.97	1 800	1 791.00	988	51	3	54
28	10 Case 12-25 HP.	16 582.15	33 767.87	1 800	818.00	699	75	4	79
29	10 Case 12-25 HP.	14 071.50	35 797.57	1 800	1 994.00	538	99	4	103
30	10 Case 12-25 HP.	17 591.28	42 348.76	1 800	1 003.00	1 124	55	2	57
31	10 Case 12-25 HP.	16 070.50	39 355.23	1 800	1 148.00	855	68	3	71
32	10 Mogul 8-16 HP.	14 496.21	47 005.77	1 800	1 682.00	565	62	4	66
33	10 Case 12-25 HP.	18 897.28	42 356.04	1 800	1 574.00	1 136	56	2	58
35	10 Avery 8-16 HP.	13 420.40	16 585.51	1 800	3 140.00	388	90	5	95
36	10 Avery 8-16 HP.	11 303.50	13 042.17	1 500	1 999.00	182	153	10	163
37	3 Fowler sets . . .	21 516.04	15 067.82	Depreciation of the material 22 000	—	904	64	2	66
38	10 Rock Island 10-20	6 302.95	10 676.10	1 200	1 670.00	270	73	3	76
39	10 Titan 10-20 HP.	4 560.30	9 905.30	600	1 780.00	180	93	3	96
40	10 Bull 20 HP . . .	6 006.27	9 965.57	600	1 315.00	236	75	3	78
42	3 Fowler sets . . .	4 670.20	3 524.00	6 825	—	273	55	3	58

(1) The Minister of Armament has allowed the Service a subsidy of 600 fr. per month per team for spare parts, repairs, etc.

The Department includes:— 1) a *Central Service* divided into several sections: — Secretary's office; Cultivation work; Material; Staff; Accountancy; Studies and Researches; Relations with private persons; 2) an *external Service*, which deals with the teams of 10 tractors supervised by a team-foreman who has under his orders an assistant-foreman, 2 mechanics, 2 smiths and a number of drivers. The technical section is responsible for the upkeep and repairs, as well as the provision of spare parts and tools for 372 tractors of 11 different types or makes, 393 ploughs of 9 different types or makes, 158 harvesters of 4 different types or makes, and 21 cultivators.

The report furnishes information as to spare parts, the service rendered by the central store, the supervision and repair of the tractors, motor lorries, travelling workshops, store cars, to the total number of 72.

After a detailed consideration of the organisation of the staff the report gives the results obtained during July, August, and September, 1917.

During these three months the teams have ploughed 47 577 acres, harvested 6 585 acres, scarified 1 703 acres, broken up 964 acres, and harrowed and rolled 3 188 acres. This work was carried out in 14 422 working days.

In Table I is given the financial statement of the department, whose general administrative expenses are divided among the teams of tractors. The cost per hectare for the different teams is given, the depreciation of the material, however, not being always included.

The report continues the description of the organisation of the Cultivation Department; it gives details as to insurance against accidents and fires; it gives full information as to the work and the section for fuels and lubricants, and concludes by showing the utility of the new Department which, according to the directors of the agricultural departments and the farmers themselves, has assured the re-awakening of agricultural life in the abandoned soils, thanks to the use of tractors. The report also indicates the results obtained by giving the farmers such information as to enable them to choose the tractors best suited to their needs.

TABLE II. — *Yield of the first 3 makes of tractor.*

[Number of days July-August-September]	Number of tractors	Area worked acres	Average yield per day for the whole of the machines. acres	Yield per day and per machine. acres	Average cost per acre, ploughed
1) EMERSON					
92	112	112 31	121.8	1.04	£ 2. 5. 10
2) CASE					
92	110	194 01	210.8	2.10	£ 1. 6. 5
3) MOGUL					
92	54	73 88	78.	1.48	£ 2. 1. 7

II. —The *Génie Rural* in commenting on the financial and technical results obtained by the Department, notes that they varied greatly, not only for the different types of tractors, but also for the various units made up of the same type.

Neglecting the FOWLER units, which proved to be the most economical as regards their yield per acre, it is found that the 32 other units included 116 EMERSON, 100 CASE, 54 MOGUL, 20 AVERY, 10 ROCK ISLAND, 10 TITAN and 10 BULL tractors.

In Table II (page 870) are compared the yields of the first 3 makes, bought in greater number and which have worked through a whole period, thus giving complete information. Table III gives the cost of spare parts.

TABLE III. — *Cost of spare parts.*

Number of tractors	Total cost	Cost per tractor	Cost per acre ploughed
116 Emerson . . . . .	£ 194. 15. 5	£ 16. 15. 2	3s. 5.4d.
100 Case . . . . .	574. 5. 0	5. 14. 7	7.1d.
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III. — The author describes the organisation of State Motoculture in Italy.

The "Ufficio Agrario Temporaneo" (temporary agricultural office), attached to the Ministry for Agriculture, makes out schemes for work in each zone of Italy, with the help of the directors of the Travelling Chairs of Agriculture and the regional delegates for increased food production.

At the request of this office, the "Ufficio Temporaneo degli approvvigionamenti" buys the machines, fuels and lubricators; it is helped by a technical Committee in choosing the types of machine, etc.

The staff (foremen, mechanics, drivers), chosen by the War Ministry from among the soldiers, is trained in two special schools, one at Rome, the other at Foggia.

The work is divided among units of 10 tractors each. Each unit has a foreman, an assistant, 4 to 10 mechanics, 20 to 26 drivers and 2 labourers. Each unit has its own deposit and lodgings for the men, as well as everything required for independent working.

A number of units form a *centre* of motorculture, commanded under military law by a centre commander. Each centre has an office stores, and a workshop for big repairs.

The units consists of tractors suitable for the locality where they work. The State owns numerous types of tractors of a power varying from a minimum of 8-16 HP. to a maximum of 30-40 HP. Besides ploughs the units are provided with harrows, rollers, drills and binders.

Farmers wishing to benefit from State motorculture, apply through the local delegates, paying a certain fee per acre.

802 — Agricultural Tractors in the United States, in 1918. — *Farm Implement News*, Vol. XXXIX, No. 11, pp. 38-66 + 1 Table + 1 Fig. Chicago, March 4, 1918.

A description, with many illustrations, of 161 tractors made by

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A description, with many illustrations, of 161 tractors made by

104 American firms, giving the chief characteristics and noteworthy details of the construction :—size ; number of driving and steering wheels, or if on chain-track system ; H.P. ; draw-bar pull ; speeds ; number of ploughs that can be hauled ; size of thresher that can be driven ; engine ; cylinders and bore ; stroke ; carburettor ; ignition ; pumps ; drive ; shaft-speed ; fuels that can be used ; tank capacity ; total weight ; works price at date of publication and liable to alteration without previous notice. The characters of the 161 tractors described in the text are summarized in table form.

803 — **Traction on Bad Roads or Land.** — LEGROS, L. A., in *Engineering*, Vol. CV, Nos. 2717, 2718, 2719, 2720, 2721, 2722, 163 Figs., 2 Tables + an Historical and a Bibliographical Appendix, London, January 25 to March 1, 1918.

The author deals with the problems involved in the design of vehicles for hauling goods or agricultural implements over the land or bad roads. He chiefly deals with tractors having more than 2 driving wheels or provided with a chain track. These two classes of tractor are applicable to different conditions, and while the methods cannot be considered as competitive, the limitations of each can be best appreciated by direct comparison of their respective peculiarities and advantages.

In the first part the author, while considering various types, deals successively with four-wheel driving, four-wheel steering, four-wheel braking, automatic differential locking gears, and the application of the four driving wheels for bad roads and arable land. Comparative figures for the different types of vehicle, their horse-power, speeds, load weight, wheel base, track width, turning radius, and overall dimensions are given by the author in a table.

The author concludes that for the transport of goods over bad roads on gradients varying from 1 in 15 on roads in which the tyres sink 2 in. to 3 in. in depth to 1 in. 5 on hard roads with bad surface, and for speeds varying from 1.5 m. p. h. on grades to 12 m. p. h. on fairly level roads, the four-wheel drive tractor has great advantages over the ordinary two-wheel drive tractor.

In the author's opinion it may be expected to rank as an important factor in the development of districts overseas not far removed from railroads, but having only primitive roads.

In part 2 of the paper chain-track tractors are dealt with and classified. The author considers methods of springing, truck frames and track-frame connections, steering, driving gear, engines, ignition and starting, radiators, speed, draw-bar pull, climbing power, etc., and he describes various English, American and French tractors, the various types being shown in illustrations. Chain-track tractors have been built in the U. S. A. and used for hauling logs since 1904, some of the original ones being still in use ; these machines have intermediate roller chains ("Phoenix", ALLIS-CHALMERS, and DIPLOCK). The author gives, in a second table, a summary of the various chain-track tractors, afterwards giving details of their construction.

The tractors described are : —

The Log-Hauler, Phoenix, of 100 H.P. ; the Centiped Truck, Phoenix,

of 50 H.P.; the 68 H.P. ALLIS-CHALMERS tractor; the HOLT Caterpillar tractors of 18, 45, 75 and 120 H.P.; the CLAYTON tractors (1) of 35 and 110 H.P.; the Tracklayer (C. I. BEST) of 16, 30, 75 and 90 H.P.; the Creeping-Grip tractors (BULLOCK) (2) including the 75 H.P. Giant, the 50 H.P. Senior, the 30 H.P. Junior, and the 16 H.P. Baby; the 15 and 35 H.P. AUSTIN tractors; the 25 and 50 H.P. STRAIT (KILLEN-STRAIT) tractors; the 25 H.P. MARTIN's agricultural tractor (3); the 30 and 40 H.P. Lefèvre (4) tractor; the 12 H.P. WOLSELEY motor sleigh.

The author gives numerous examples of the use of chain-track tractors for ploughing and for transport on bad roads unsuited for the conveyance of heavy loads. He calculates that the cost of traction is  $\frac{1}{3}$  to  $\frac{1}{5}$  that by means of horses or mules. Besides their use for cultivation and road haulage, the author mentions the use of chain-track tractors for excavating drainage trenches (5); amongst these, the PARSONS excavators (20, 30, 45, 62 and 80 H.P.) and AUSTIN excavators (15 to 85 H.P.) are described.

The author concludes that where a track can be found 7 ft. wide which does not present rocky obstacles over 10 in. high, whether over sand, ash, clay, marsh, snow or ice, on the level, or on gradients up to 30 per cent., the chain track tractor has proved itself capable of travelling and performing useful work beyond the capacity of animal haulage. For this reason the chain-track tractor may be expected to occupy a position of ever-increasing importance in the development of new countries and in places where it is necessary to transport machinery and stores over roadless country many miles from the railway. Mr. LEGROS does not regard any one of the existing systems as perfect and expects that much will be done to improve the vehicles in the near future.

There is probably room for considerable improvement in the chain-track itself as well as in its supports and its anti-friction devices. The variation in resistance to haulage is so great as between one system and another, not merely in static resistance to starting, but in dynamic resistance to haulage, that, as the author has already suggested, the various track systems should form the subject of comparative tests at some of the great agricultural colleges. One feature that is particularly remarkable is the small amount of power lost in compressing soft marshy land under the feet of the track chains.

804 - **The Ford Tractor (6) and the Oliver M. O. M. Plough in England.**—*The Journal of the Board of Agriculture*, Vol. XXIV, No. 12, pp. 1456-1457. London, March, 1918.

In the Letter No. 79/M. 1, dated February 26, 1918, the Food Production Department of the Board says that is essential that the Ford tractor should be used only with the new type Oliver M. O. M. plough which was specially designed to work with it, and which is supplied with each Ford tractor. The tractor and plough together form a unit, and on no account must this tractor be used with any other type of plough.

(1) See R. 1918, No. 678; — (2) See B. 1915, No. 1912; — (3) See R. 1918, No. 678; — (4) See R. August, 1917, No. 753; — (5) See R. 1917, No. 1053. — (6) See R., 1917, No. 755. (Ed.)

The new Oliver plough is giving great satisfaction for both grass and stubble ploughing.

According to trials carried out on the farm of the Haiper Adams Agricultural College in February, 1918, the Ford tractor and the new Oliver plough gave good results in breaking up a grass field not previously ploughed for about 20 years. The special features of the Ford tractor are:—extreme accessibility of the engine parts; reduction of the lubrication parts to 11 oil-holes and grease-cups; the possibility of turning in a minimum space; direct attachment of the plough to the tractor; only one operator is required, the control levers of the plough being easily accessible to the tractor driver from his seat. As regards the Oliver plough the outlift at the end of the furrow is automatic, and the depth at which the plough is working can be easily regulated.

The plough has a skim coulter that turns in the upper layer of the turf, and at the same time keeps clean the surface of a swivel disc coulter replacing the usual knife-form of coulter. The mouldboards are well shaped and turn the furrow slice satisfactorily to a good depth. A depth of 8-9 in. was maintained satisfactory on level ground, second speed being used on the tractor. The mouldboard is of a type and setting unusual in England. Longitudinally it is concave, and transversely convex, while it is set out at an angle of 45°. The work done by the plough resembles that of fallow land ploughed with a digging plough. The land is left very light, and it is obvious that the ploughing must be followed by a discing to secure the necessary compactness, but an abundance of loose mould is produced which is not the case with the older system of ploughing. The character of lea ploughing produced is revolutionary, but there is every reason to anticipate that this type will be superior to the type of ploughing generally adopted.

805 - **Disc-Harrow Trials at Montpellier, France.**—CLAROT, C., in *Le Progrès Agricole et Viticole*, Year XXXIX, No 15, pp. 343-350, 3 Figs. Villefranche, April 14, 1918.

Disc-harrows were introduced into France a long time ago, and they are now much in favour as they are of great interest to farmers and southern winegrowers.

The author gives the results of trials that he carried out at the Montpellier School of Agriculture with the disc-harrow under widely different conditions. The trials were made a "Cotton" 6-disc harrow, supplied by the firm of BOMPARD, at Montpellier. The machine is 49 in. wide, 28 in. high without the seat, 51 in. long without the shaft, and 14 ft. with the shaft. Its total weight is about 660 lb.; the discs are 17.32 in. in diameter.

The machine was tested in a vineyard. But owing to its dimensions, and the space required for the team, it can only be used where there is at least a space of 79 in. between the vines; space is also necessary to allow for turning at the end of each row.

1) *Trial at Mas de Rochet (near Castelnaud) February 23.*—The harrow worked in a recently-ploughed sandy soil at its maximum depth of 4 to 5 in. on the first turn. There was no weight on the machine, as the

"Cotton" harrow has no arrangement to allow of this. The work was done along the furrow slice and was well done. Cultivation was not necessary as the soil was already well broken up.

2) *Trial at Mœstroun (Farm of the School of Agriculture at Montpellier), March 7.* — The Mœstroun vineyard had not yet been ploughed and the harrow turned the soil under; its work was comparable with that of an ordinary vineyard hoe. The ground was sloping; during the descent the discs did not enter the soil sufficiently, while in ascending the work was good. The tilth obtained with the pulveriser in the first turn was the same as that given by the hoe. After the first turn the pulveriser worked more deeply than the hoe. The depth was 3 in. during the first turn. The work was hard on the horses. A one horse hoe passes among all the vines but the harrow hauled by 2 horses requires 6 ft. 6 in. between the vines.

The great advantage of the pulveriser is that, in passing twice over the same ground, it would replace the plough; and that in two turns it does sufficient work almost equal to 6 furrows of the plough. In addition the grass was destroyed much better than with the hoe.

3) *Trials at Mandou (Land near the School of Agriculture at Montpellier), March 6.* — The soil was loamy, with abundance of couch-grass, and had already been ploughed and cultivated. The harrow did not destroy the couch-grass very satisfactorily. The spring-tine harrow had given much better results. Another turn with the plough would probably have been much more useful.

At Mandou the harrow was coupled to a 5-10 HP. Avery tractor, a dynamometer being placed between to register the draught of the one and the power of the other. A width of 47 in. was cultivated at each turn. The results of the trials are given in the following table.

*Comparative draught of a disc-harrow and a spring-tine cultivator.*

Disc-harrow				Cultivator		
Depth metres	Type of work done	Tractive effort in kg.	Tractive effort per metre (1) in kg.	Type of work done	Tractive effort in kg.	Tractive effort per metre (1) in kg.
0.02	Incomplete . . . .	130	110	— . . . . .	115	115
0.03	Incomplete . . . .	160	130	— . . . . .	125	125
0.04	Good . . . . .	200	160	Good scratching . .	150	150
0.06	Does not break soil up . . . . .	225	185	Excellent work . .	200	200

(1) Tractive effort per metre of width worked.

It will be seen from this table that at equal depths the draught of the 2 machines is practically the same; but the machines are not made

to work at the same depth. If the harrow goes deeper than 5 cm., it does not work well at all.

4) *Test at Bellevue (Commune of Montpellier), March 8.* — Field spring and autumn-ploughed; compact, damp soil, with occasional big clods left by deep ploughing and untouched by other hoe or roller.

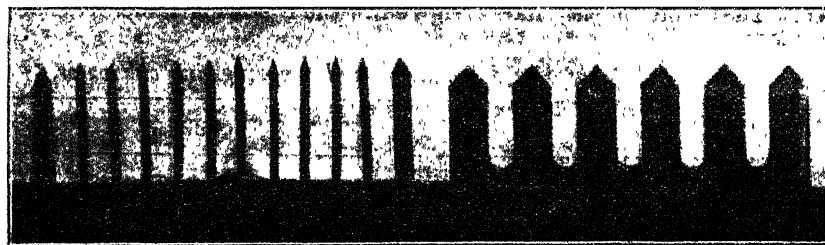
The most suitable average depth was found to be 6 cm. for the pulveriser. The work was not too heavy for the horses; in 80 minutes 0.4 hectare was worked; which is equivalent to 3  $\frac{1}{2}$  hours per hectare. Normally, 2 to 3 hectares could be done a day. The results obtained were the best of the 4 trials.

The model tested was not suited for vineyard work, as a 6-disc harrow requires 2 horses. This prevents the use of the machine in vineyards having less than 6 ft. 6 in. between the rows. It is, however, very suitable in new vineyards with a width of from 6 ft. 6 in. to 7 ft. 4 in.; 8-disc harrows might even be used, and with vines on iron wire, even 10-disc harrows. The author considers that the harrow is interesting and that, used at the right moment under suitable conditions, it might be of great service to farmers for destroying weeds, etc.

806 — **A Weeding Rake for Low Vines.** — SAVASTANO, L., in *R. Stazione sperimentale di Agrumicoltura e Frutticoltura, Acireale, Bollettino No. 34*, pp. 1-2 + 1 Fig. Acireale, April, 1918.

The author has invented this tool so that women and children can weed low vines more easily in summer.

*Weeding rake for low vines.*



A  
type with broad, flat teeth.

B  
type with round or square teeth.

If, instead of using the hoe, an ordinary rake is used, many of the weeds are removed, but those with tap roots remain with the root intact, so that they quickly grow again. To avoid this, the two end teeth of the rake have been modified by making them like a knife blade with an external cutting edge. The dimensions are: —length of blade 14 in.; length of teeth 5 in.; length of handle about 5 ft. so inclined to the blade that no stooping is required when using the rake. When a tap-rooted plant comes under the rake, the tool is lifted and the root struck with the blade.

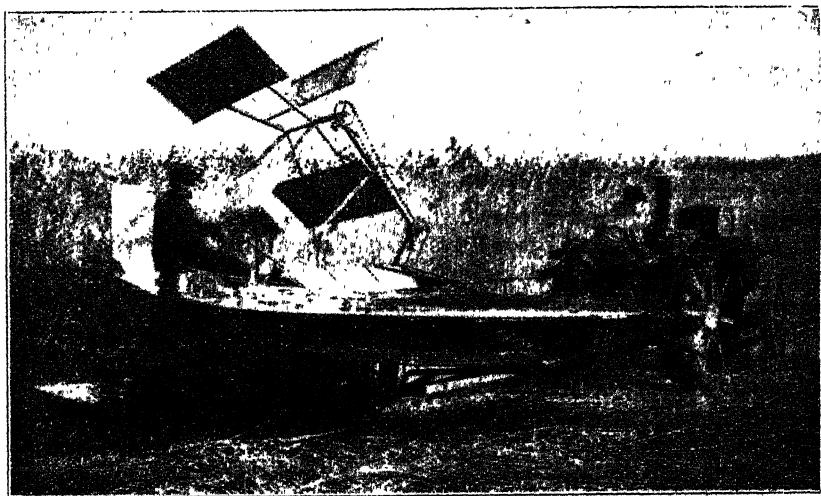
Of the 2 types of rake shown on the figure by the letters *A* and *B*, the first has broad, flat teeth, and the second round or, better still, square teeth. One or the other is used according to the kind of soil.

**807 - Economic Advantages Resulting from the Use of Machinery in Harvesting Wheat.** — See No. 812 of this *Review*.

**808 - A Hemp Harvester.** — *The Implement and Machinery Review*, Vol. XLIII, No. 516, p. 1291, 1 Fig. London, April 1, 1918.

This harvester is made by the INTERNATIONAL HARVESTER CORPORATION, Chicago, U. S. A., being devised with idea of enabling hemp to be grown on a large scale notably for the manufacture of binder twine. In 1917, the Ridge Land & Navigation Co., of Stockton, California, raised 4 000 acres of hemp and handled the whole crop by machinery.

This hemp harvester is of necessity much larger and heavier than a grain binder, for hemp may grow from 6 to 9 ft. high. Hemp of this height is most desirable and produces the best fibre. Because the hemp grows so high a wider platform has to be provided and the reel has to be much higher and fitted with special fans. A heavy knife, with special guards, is also essential.



Hemp harvester.

In order that the hemp may be spread on the ground so as to ret properly, and so that each swath may be moved out of the way of the horses and harvester on the next round, the hemp is moved to the right and placed down at right angles to the machine. A circular carrier accomplishes this, as shown in the appended illustration, the mechanism laying the hemp in a nearly straight line, and at almost perfect right angles to the harvester.

The retting of hemp requires from 2 to 3 weeks to 2 or 3 months, depending on the humidity and the temperature. Three machines are required to complete the cycle of harvesting hemp and producing the fibre. When the retting is complete the hemp binder picks up the hemp and ties it into bundles, which are shocked similarly to maize, with the difference that the shocks are made more open to permit a free circulation of air. When the shocked hemp is ready, it is taken to the braker, from which it passes to the scutcher.

### 809 - Review of Patents.

**TILLAGE MACHINES AND IMPLEMENTS.** — *Italy*: 158480 Rotary motor-plough; 159764 Rotary plough.

*United Kingdom*: 113684 Agricultural skimmer plough; 114028 One way motor plough.

*United States*: 1258109 Rotary cultivator; 1258286 Multiple disc plough for mechanical traction; 1258287. Disc cultivator attachment; 1258681 Plough; 1258951 Lister plough; 1259174 Agricultural implement frame; 1259511 Power lift tractor lister; 1259638 Traction plough; 1260079 Cultivator; 1260318 Harrow; 1260497 Disc harrow; 1260573 Landroller; 1260738 Power propelled agricultural machine; 1260752 Plough coulter.

**DRAINAGE AND IRRIGATION.** — *Switzerland*: 77759 Drainage pipe.

*United States*: 1258240 Irrigation water elevating device; 1258759-1259746 Ditch or drain forming device; 1259211 Irrigation apparatus; 1259684 Drainage pipe.

**MANURES AND MANURE DISTRIBUTORS.** — *France*: 486840. Physiological manure composed of the plant's natural salts for directly and locally fertilizing any agricultural seed or plant.

*United Kingdom*: 113571 Process and apparatus for producing a nitrogenous manure from straw or other material containing fermentable carbohydrates by fixation of atmospheric nitrogen; 113648 Process for producing calcium superphosphate.

*United States*: 1258378 Straw spreader; 1259456 Harvesting and reduction apparatus for sea kelp; 1259457 Kelp incinerator; 1259739 Spreader; 1260219 Fertilizer spreader; 1260332 Combined cultivator and fertilizer distributor; 1260777 Apparatus for distributing fertilizers.

**DRILLS AND SEEDING MACHINES.** — *Netherlands*: 2378 Bulb planter.

*United States*: 1259033 Seed planting attachment for cultivators; 1260174 Ridging attachment for planters; 1260808 Planter.

**VARIOUS CULTURAL OPERATIONS.** — *France*: 486641 New system of cultivation.

*United States*: 1258085-1259940 Cultivators; 1258275 Portable machine for fastening vines to supports; 1258340 Cotton chopper; 1258680 Wheeled cultivator; 1260332 Combined cultivator and fertilizer distributor; 1260746 Sugar cane cultivator.

**CONTROL OF DISEASES AND PESTS OF PLANTS.** — *France* 486556 Regulator for dusting and similar machines.



*Switzerland* : 77763 Process for manufacturing a product for destroying pests.

*United States* : 1258504 Insect catcher ; 1258930 Quack-grass destroyer.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *France* : 486735 Improved motor-binder.

*Italy* : 159363 Lifter for harvesting lodged cereals.

*Switzerland* : 77881 Fruit picker.

*United Kingdom* : 114082 Flax pulling machine.

*United States* : 1257972-1259767 Maize harvesters ; 1258277 Cotton picker ; 1258671 Chain sickle mower ; 1259465 Reaper ; 1259647 Shock binder ; 1259803 Self cleaning rake ; 1260031 Gang mower ; 1260410 Butt adjuster for maize harvester ; 1260906 Rake.

MACHINES FOR LIFTING ROOT CROPS. — *United States* : 1258456-1258818-1260715 Beet topping machines ; 1258819 Beet digging machine ; 1259178 Beet harvester.

THRESHING AND WINNOWER MACHINES. — *United States* : 1258354 Separator ; 1258858 Forced straw stacker for threshing machine ; 1260014 Band cutter and feeder for threshing machine ; 1260227 Grain separator.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *France* : 486822 Fodder loader.

*Italy* : 160096 Improvement to machines for grinding cereals, oats, chestnuts, etc.

*Netherlands* : 2371 Latex coagulating apparatus.

*Switzerland* : 77880 Process and apparatus for ventilating haystacks.

*United Kingdom* : 113700 Apparatus for packing grains, etc.

*United States* : 1258125-1259678 Peanut shellers. 1258142 Shock loader ; 1258217 Seed maize drier ; 1258245 Pepper peeling machine ; 1258848-1259961 Baling presses ; 1258958 Fruit sizing machine ; 1259034 Attachment for gin-feeder ; 1259081 Variable speed drive mechanism for cotton gin ; 1259613 Fruit packing press ; 1259905 Fruit and melon grader ; 1260059 Beet loading machine.

FORESTRY. — *France* - 486895 Heath grubbing machine for animal traction.

*Switzerland* : 77761 Plant for cutting and bundling twigs.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *France* : 486651 Motor-windlass car ; 486767 Tandem tractor.

*Italy* : 156674 Driving wheel for tractor and motorplough.

*United Kingdom* : 113497-114109 Power cultivation of land (haulage by cables).

*United States* : 1257976 Power attachment for automobiles ; 1257999 Farm and road tractor conversion attachment ; 1258221-1258362-1258512-1258973-1260259 Tractors ; 1258288 Chain track drive and support for tractor ; 1258329 Truck for converting an autocar into a tractor ; 1258489 Tractor gearing ; 1258501 Tractor wheel rim ; 1258502 Agricultural tractor ; 1258601-1258612-1258613 Track chains ; 1258602-1258605 Endless trackbelt tractors ; 1258603 Traction engine with a pair of endless tracks and one steering wheel ; 1258607 Wheel for tractor truck

mechanism; 1258608 Track link construction; 1258611 Support for chain track; 1260402 3-horse draft equalizer.

FEEDING AND HOUSING OF LIVESTOCK. — *Italy*: 159264 Liquid, concentrated or solid animalized vegetable milk for rearing stock.

*United Kingdom*: 113988-114115 Horseshoes.

*United States*: 1259071 Hay distributor; 1259084 Calf feeder; 1259112 Hog trough; 1260339 Fly catcher for stables and barns.

POULTRY FARMING. — *United States*: 1258037-1259726 Incubators; 1258069 Mechanism for feeding device.

FISHING. — *United States*: 1258213 Fish hook.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Italy*: 159569 Bolt-ing machine drive.

*Netherlands*: 2427 Improvement to sugar cane crushers.

*Switzerland*: 77926 Hand mill with two superimposed plates for treating fruit stones.

*United Kingdom*: 113486 Bakers' yeast; 113530 Apparatus for extracting oils from seeds, etc., by solvents; 113558 Conveyor for mechanical bread making; 113628 Rotary filtering drum for pressing yeast; 113997 Process for reduction of grain in view of increasing the yield of flour from wheat and other cereals; 114024 Apparatus for depericarping palm nuts, olives, etc.

*United States*: 1258571 Apparatus for decorticating, washing and drying sisal and other fibrous materials; 1258866 Machine for working dough or other plastic substances; 1258981 Fruit juice extractor; 1259213 Fruit slicing machine; 1259483 Milk substitute composed of edible oil, flour, glucose, salt and water; 1259774 Apparatus for drying tomatoes and fruit; 1260053 Fruit press; 1260399 vegetable slicing machine.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *Italy*: 159839. Process and apparatus for the rapid tanning of skins.

DAIRYING. — *United States*: 1258036 Milkcan; 1258095 Churn-dasher; 1258902 Milk sterilizer; 1258996 Method of making composition butter; 1258997 Artificial butter composed of cream and condensed skimmed milk; 1259047 Ventilating cream can cover; 1259323 Combined stool and milk pail; 1260127 Milk pasteurizer.

FARM BUILDINGS AND EQUIPMENT. — *Italy*: 159799 Bottom drained MARIANECCI silo for storing sugar beet pulp.

*United States*: 1259021 Grain elevator structure; 1259039 Farm gate; 1259080 Portable shelter.

VARIOUS. — *United States*: 1258048 Orchard-ladder on truck; 1258198 Adjustable horse collar; 1259055 Horse collar; 1259239 Orchard ladder; 1259669 Soil testing machine.

#### FARM BUILDINGS

810 — Movable Pig-Houses. — I. EDWARD, J. M. and DAVIDSON J. B., extracted from *Agricultural Experiment Station, Iowa State College of Agriculture and the Mechanical Arts, Bulletin No. 152, Ames, Iowa, U. S. A.*, published in *Missouri State Board of Agriculture Monthly Bulletin*, Vol. XIV, No. 5, pp. 54 + 37 Figs. + 2 Tables. Columbia, Missouri. May, 1916. — II. MAC VEAN, J. D. and HUTTON, R. E., in *U. S. Dept. of Agriculture, Office of the Secretary, Circular No. 102*, pp. 8 + 6 Figs. Washington, February, 1918.

I. — Movable pig-houses of suitable construction are of great use if

they are adapted to local conditions. The model pig-houses described in the bulletin under consideration were tested at the Iowa agricultural experiment station. These pig-houses are practical and based on long study of pig-rearing in the United States.

After describing the requirements for the site and the construction of pig-houses, the authors give the advantages and disadvantages of pig-houses consisting of single, isolated and portable sties as compared with central permanent piggeries containing many sties with or without movable partitions. Among the advantages claimed for single-sty pig-houses each containing a sow and her litter, are :—

- 1) the ease with which the house may be taken down and moved about to suit the needs of the farm ;
- 2) the rapid isolation either for sows about to farrow, for protecting the young, or for the growth of young pigs, and for selection ;
- 3) improved sanitary conditions, both for the prevention of disease and rotation of pasture ;
- 4) simplicity of construction.

These pig-houses are more practical and cheaper for beginners or breeders on a small scale, and they are more suitable to farming conditions, being portable. A limited number of the houses can be warmed with oil-lamps, and the risk of fire is less. The single-sty, portable pig-house combines perfectly with permanent piggeries by acting, when required, as a supplement to the latter. Amongst the disadvantages, it should be noted that :—

more labour and time is required for tending the herd as the houses are scattered about ; they do not last as long ; it is difficult to heat many houses at the same time ; the lighting and ventilation are imperfect ; the manure is often not removed on account of the distance between the sties ; the care, feeding and watering are more difficult.

A larger number of types of portable pig-house have been constructed by the live-stock and farm engineering departments. Many of them only differ as regards the placing of the doors and the provision of hinged walls to serve as shelter, ventilators and windows.

The authors describe the various types, giving plans and estimates for the 6 chief single pig-houses tested.

Among these the " Iowa Gable Roof House " was used successfully by the Iowa agricultural experiment Station. As is shown in fig. I, it is of simple construction ; its vertical walls can be lifted up, thus giving a greater area for shelter ; one of the sides of the roof, which should face either to the east or south, has two flaps which open or close like a door, so as to uncover or cover two glazed windows. The entrance can be either in front or at the side. The frame and walls are of wood ; there is a floor of 2 in. planks, but this can be omitted if the site is sufficiently dry.

The construction of the house is shown in a design, the various dimensions being given. It is about 9ft. long, 7ft. wide and 4ft. 6 in. high to the ridge. In Iowa the wood and labour required cost \$ 8.94.

Figure 2 shows the " A " pig-house, so-called from its resemblance to

that letter. The sides have a hinged division that can be lifted up to give shade in summer. In another "A" type of pig-house one of the sides has a leaf that can serve as a door.

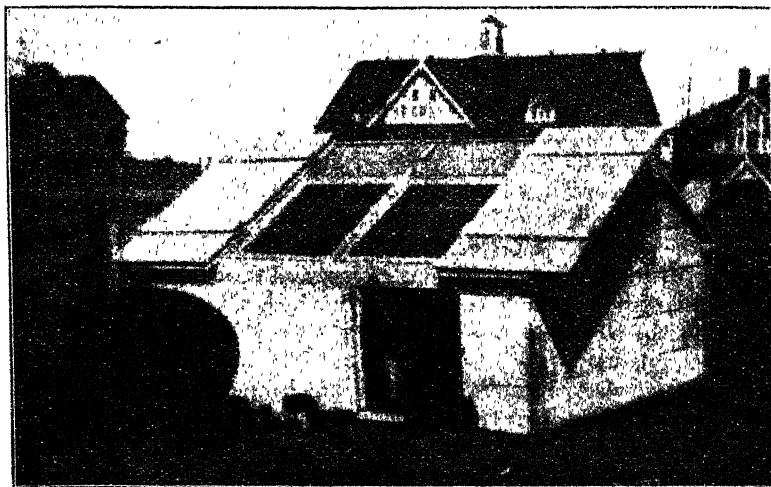


Fig. I. — Iowa gable roof house (spring and autumn).

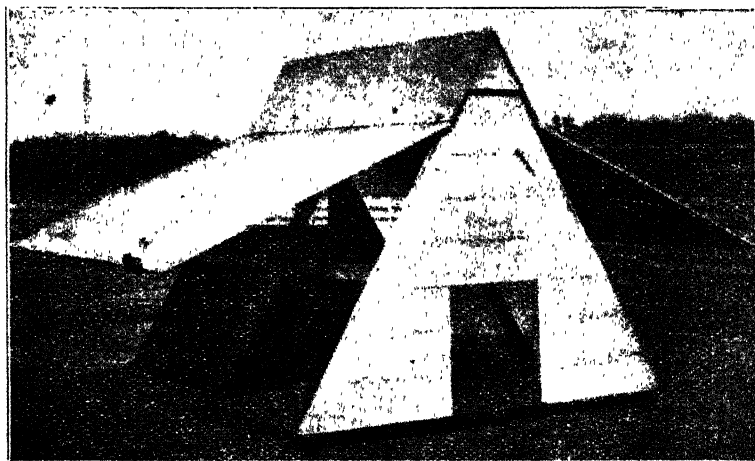


Fig. II. — "A" house with lateral flaps (summer).

The "A" pig-house is of simple construction and can be erected very quickly. It is highly favoured by a large number of breeds. It is made in varying sizes, the one illustrated being 9ft. long, 7ft. wide at the base and

6ft. 6 in. high to the ridge. The doors may be placed so as best to suit local conditions. On the side opposite to the door is a ventilator, which may be opened or closed according to the weather. This type is made of wood and costs about the same (\$ 8.94) as the Iowa gable roof house. The ever-increasing cost of wood has led to the construction of type "A" pig-houses in metal. The experience obtained under Iowa conditions show that the metal houses are warmer at noon and colder at night than the wooden houses.

II. — Portable pig-houses which can be taken to pieces are of great use especially in regions having mild winters and serve to shelter the pigs against both the summer sun and winter damp and storms. These single pig-houses can be moved from one pasture to another when the pigs are changed to fresh pasture.

These shelter-houses form an important factor in the development of pig breeding, for they are suitable for housing the spring litters and are cheaper than larger buildings. The circular contains instructions, figures and plans for building 2 ordinary types of portable, single pig-house. The type "A", is about 8 ft. wide at the base and 6ft. long and the lateral flaps that forms the gables are 8 ft. long.

The type "A" is very suitable for fattening spring pigs, or for housing a sow and her litter in warmer climates. In cold regions where it snows and there is much wind, the house should be made as warm as possible by covering it with tarred paper. This is especially necessary in the north if the house is to be used for farrowing. The interior heat may be conserved by covering the house with straw, leaves, etc. In hard weather, a couple of lamps could be lit and hung from the roof of the house.

## RURAL ECONOMICS.

### 811 — Important Factors in the Operation of Irrigated Farms in Utah, U. S. A. —

BROSSARD, E. B., in the *Utah Agricultural College Experiment Station Bulletin* No. 160, pp. 48, 49 Tables, 16 Figs. Logan, September, 1917.

In order to promote the maximum economic agricultural production of existing farms and the agricultural development of many thousands of acres of new land, the Utah Agricultural College, in collaboration with the U. S. Dept. of Agriculture, has carried out an inquiry to determine, according to the experience of practical farmers, the most profitable systems of farm management on irrigated Utah farms and which can be applied by those wishing to obtain farms in Utah, and also to furnish bankers, officers of loan associations, and other capitalists who loan money on irrigated farms in Utah useful information regarding the average value of such securities. The inquiry is based on records from 309 irrigated Utah farms for 1914. The records were taken in 7 typical general farming areas in 7 typical counties of Utah. The climate, crop, and livestock conditions in Utah in 1914 were about normal.

The following facts were brought out by this investigation :—

I. — FARM CAPITAL. — 1) A greater percentage of the capital is di-

rectly productive on farms with large capital than on farms with small capital.

2) There is less waste land in proportion to the total farm area on the farms with large capital.

3) A large farm capital is usually accompanied by a greater number of acres and crop acres. The proportionate area cropped is about constant.

4) On the average, crop yields are a trifle better on farms which have a large capital. This seems true, however, only when farm capital is less than \$ 20 000.

5) A large farm capital is usually accompanied by large numbers of productive animal units.

6) The farms with large capital are usually the most intensely stocked.

7) A large farm capital is usually accompanied by a comparatively high value per acre of land and buildings.

8) A large farm capital is on the average accompanied by a decrease in the value of machinery per crop acre, and by an increase in the number of crop acres per \$ 100 worth of machinery.

9) Horse labour is more efficient on the farms with large capital.

10) When the same farm crops are raised man labour on crops is more efficient on farms with large capital than on farms with small capital.

11) When approximately the same kind of livestock is kept, man labour with livestock is more efficient on farms with large capital than on farms with small capital.

12) Farms with large capital have more capital per man than farms with small capital.

13) As a result of the foregoing economies, farms with large capital are more profitable than farms with small capital, as shown by the increase in the farmers' labour income.

14) The total net income from the average of 309 irrigated Utah farms was about as follows, in 1914:—

5 % interest on average capital of \$ 11 886. . . . .	\$ 594
Average farmer's labour income . . . . .	\$ 541
Value of farm products consumed by average farm family . . . . .	\$ 600
11.625 % of \$ 7482, increase in value of average irrigated farm land on 309 irrigated Utah farms, 1914. . . . .	\$ 870
Total net income . . . . .	\$ 2 605

15) Labour income is less in proportion to farm capital on farms with large capital than on farms with small capital.

16) Labour income increases in the same ratio as farm capital until farm capital reaches \$ 20 000 or over. Beyond this, as capital increases 1 %, labour income increases only about 0.33 %.

II. — SIZE OF FARM — 1) There are more acres of crops, on the average on the large farms than on the small farms. But, the proportionate area cropped is less on the large farms than on the small farms.

- 2) A larger percentage of the farm capital is employed in directly productive enterprises on the large farms than on the small ones.
- 3) The shelter cost per unit of livestock is lower on the large farms than on the small farms.
- 4) Each \$ 100 worth of machinery is more efficient on the large farms in that it cultivates more acres of the same kind of crops and consequently lessens the value of machinery per crop acre.
- 5) Horse labour with crops and livestock is more efficient on the large farms.
- 6) Man labour with crops and livestock is more efficient on the large farms.
- 7) As a result of the foregoing economies on the large farms, they are more profitable as shown by the greater size of the farmer's labour income. This is \$ 336 for farms of from 10-39 acres and rises as the size of farm increases till it attains \$ 991 for farms of from 300-500 acres
- 8) The farmer's labour income is less in proportion to the total farm capital on the large farms than on the small farms.
- 9) Over half of the labour income from the average irrigated Utah farm is increase in inventory of farm capital. The most important increases in the farm inventories are in livestock and feed. This seems to indicate that Utah farmers realise the advantage of increasing the number of livestock on their farms.

III. — OTHER IMPORTANT FACTORS. — 1) On an average the farms with the highest crop yields per acre are the most profitable.

2) When average crop yields are maintained, the size of the irrigated Utah farm influences the labour income of the farmer more than increased crop yields per acre.

3) The number of livestock and the net livestock receipts per productive animal unit affect directly the farmer's labour income—as either increases the farmer's labour income increases. Both are important factors in the operation of irrigated Utah farms.

812 - Cost of Harvesting Wheat by Different Methods in the United States. — YERKES, A. P. and CHURCH, L. M. in *U. S. Dept. of Agric. Bulletin No. 627* (Office of Farm Management), pp. 1-24. Washington, D. C., February 13, 1918.

By far the largest percentage of the wheat of the United States is to-day harvested with the binder, the use of this machine being almost universal. The only wheat-growing sections where the binder is not used on the greater part of the crop are in the States of Washington, Oregon, and California and parts of Idaho; Utah, Wyoming and Montana, where much of the wheat is cut and thrashed with combined harvesters although even where these outfits are commonly used binders also are employed to some extent.

The cost of harvesting may be somewhat greater where the binder is used than where the work is done with headers or combined harvesters. The binder, however, has a distinct advantage over these machines in that the work of harvesting may be begun from one to two weeks earlier with the binder than with either the header or combine, since wheat can be cut with a binder while in the early dough stage and placed in shocks to

complete ripening, thus requiring fewer horses and men to harvest a given acreage. The cost of harvesting wheat with a binder varies considerably being influenced by several factors, *i. e.*, size of the outfit used, yield per acre, especially of the straw, the character of the soil, whether soft or firm, rough or smooth and the topography of the farm, whether level or hilly, the working ability of the horses used and the condition of the working parts of the machine. The figures given in Table I approximate the average conditions as far as possible, assuming man-labour to be worth \$2 per day and horse-labour \$1.20 per day.

TABLE I. — *Average acres cut by 6, 7 and 8 foot binders in a 10 hour day (235 Reports) and labour cost of cutting one acre of wheat with binders of different sizes.*

Width of cut and number of horses	Acres cut			Cost per acre		
	per binder	per horse	per foot of cutter bar	total labour \$	man labour \$	horse labour \$
6 foot, 3 horses . . . . .	10.90	3.63	1.82	0.51	0.18	0.33
6 foot, 4 horses . . . . .	12.10	3.03	2.02	0.57	0.17	0.40
7 foot, 3 horses . . . . .	12.50	4.17	1.79	0.45	0.16	0.29
7 foot, 4 horses . . . . .	15.10	3.78	2.16	0.45	0.13	0.32
8 foot, 4 horses . . . . .	17.00	4.25	2.13	0.40	0.12	0.28

*Interest and Depreciation.* — The cost for interest and depreciation on binders, based on tabulation of 235 Reports, was \$0.24, 0.16 and 0.125 per acre annually, for the 6, 7 and 8 foot binders respectively with a life of the binders of 15, 11 and 10 years and 750, 1100 and 1500 acres respectively.

The acres cut annually by a binder do not seem to have a very direct influence upon its life except where the acreage is extremely large. There is a certain deterioration due to age which appears to limit the length of life in years whether the binder does a fair amount of work each season or not.

*Repairs.* — Many farmers have reported the use of a binder for several years without a cent being spent for repairs, whereas in other cases repairs have ranged from \$10 to \$15 annually. As a rule the most expensive item of repairs is the canvas. If properly protected when idle, a binder canvas should cut from 400 to 800 acres. It is believed that 20 per cent. of the first cost for six-foot binders, 25 per cent. for seven-foot and 30 per cent. for eight-foot machines will approximate the average repairs required for these outfits.

The cost for shelter has been omitted because this item varies so greatly and in many cases is insignificant, since a great many binders, particularly in the West, have no shelter whatever except for the canvasses and sickles, which usually are taken off and stored in a dry place during the winter.

*Auxiliary Binder Engines.* — The use of binder engines furnishing power to operate the mechanism, which is ordinarily driven by power from



the horses through the medium of the bull wheel, has increased considerably during the last two or three seasons particularly in certain sections where wet ground has made the operation of the binder difficult. These engines cost about \$ 150 but their use is not confined to the binder alone, being utilized for belt power. Under these conditions their estimated average life is about 9 ½ years. In some instances the engines are used practically every day of the year for pumping water, except while on the binder.

The owners of these outfits report that from 2 to 5 gallons of gasoline are required to operate the engine per day, while about 1 pint of lubricating oil per day appears to be a fair average. With gasoline at 20 cents per gallon and lubricating oil at 40 cents this would make the daily operating expense about 85 cents. Reports from farmers indicate that an increase of from 4 to 5 acres per day may be expected in the area covered with the binder under unfavourable conditions previously mentioned. The repairs on the outfits averaged \$ 3 annually.

*Shocking.* — The practice of shocking wheat after being cut with a binder is almost universal. The average acres shocked per day per man and cost per acre and per bushel in relation to yield per acre are shown in Table II.

TABLE II. — *Acres shocked per day per man and cost per acre and per bushel in relation to yield per acre (Based on labour at \$ 2 per day, 264 Reports).*

Yield per acre	Average yield per acre	Acres shocked per day man	Cost per acre	Cost per bushel
Under 20 bushels . . . . .	15	12 ½	\$ 0.16	\$ 0.01
20 bushels . . . . .	20	12	0.16 ½	0.008
21 to to 30 bushels . . . . .	26.2	8 ¾	0.23	0.009
31 bushels and over. . . . .	37.4	7 ½	0.26 ½	0.007

*Comparison of Costs — Old methods versus new.* — It is very interesting to compare the costs of cutting wheat as it is usually done to-day, with the methods in use 75 years ago, according to the *Transactions of the New York State Agricultural Society* (Vol. 10, 1850). Based on labour at \$ 2 per day, the cost per acre by the hand method, with an average yield of 16 bushels per acre, would have been approximately \$ 1.60 75 years ago as against \$ 1.23 with the binder. But to-day two men (one shocking) with three or four horses will cut, bind and shock about eight times as much wheat as two men cutting with a cradle and binding by hand. Taking wheat prices and labour prices into consideration, the cost of harvesting in recent years has represented about one eleventh of the selling price of the crop, whereas in 1850, when hand methods were used, the cost of harvesting represented less than one thirtieth of the selling price.

*Stacking.* — Six acres per day for two men and one team appears to be a fair day's work in stacking wheat under most eastern conditions, whereas in the western sections, where the more efficient methods are employed,

8 acres per day for two men and two horses and 10 acres per day for two men and four horses would appear to be a fair average. Based on these figures the cost of stacking per acre for man and horse-labour would be as shown in Table III.

TABLE III. — *Labour cost per acre and per bushel of stacking wheat with man-labour at \$ 2 and horse-labour at \$ 1.20 per day of 10 hours.*

Operation — No. of horses	Acres covered per day	Labour cost per acre			Cost per bushel (16 bushel yield)
		Man	Horse	Total	
1 man pitching and 1 loading (1 wagon) 2 . . . . .	6	\$ 0.66 1/2	\$ 0.40	\$ 1.06 1/2	\$ 0.06 1/2
2 men pitching (1 wagon) 2 . . . . .	8	0.50	0.30	0.80	0.05
2 men pitching (2 wagons) 4 . . . . .	10	0.40	0.48	0.88	0.05 1/2

TABLE IV. — *Cost of harvesting an acre of wheat with headers of various sizes and different size crews, with man-labour at \$ 2 and horse-labour at \$ 1.20 per day of 10 hours.*

Size of header and crew	Daily cost of operating the outfit				Cost per acre	Cost per bushel	
	Total	Man labour	Horse labour	Interest, depreciation and repairs on headers		Based on 11 bushel yield	Based on 30 bushel yield
12-foot, with 5 men and 10 horses (1) . . . . .	\$ 25.40	\$ 10.00	\$ 12.00	(2) \$ 3.40	\$ 1.06	\$ 0.07	—
12-foot, with 6 men and 14 horses (3) . . . . .	» 32.20	» 12.00	» 16.80	(2) » 3.40	» 1.34	—	\$ 0.045
14-foot, with 6 men and 12 horses (1) . . . . .	» 29.75	» 12.00	» 14.40	(5) » 3.55	» 1.06	» 0.07	—
14-foot, with 8 men and 16 horses (6) . . . . .	» 38.55	» 16.00	» 19.20	(3) » 3.35	» 1.38	—	» 0.046

(1) Crew made up as follows: 1 driver and 6 horses with header; two header wagons with 2 drivers and 4 horses; 1 man loading wagon and 1 man on stack.

(2) Based on annual duty of 300 acres and 24 acres per day.

(3) Crew made up as follows: 1 driver and 8 horses with header; 3 wagons with 3 drivers and 6 horses; 1 loader and 1 man on stack.

(4) Crew made up as follows: 1 driver and 6 horses on header; 3 wagons with 3 drivers and 6 horses; 1 loader and 1 man on stack.

(5) Based on annual duty of 450 acres and 28 acres per day.

(6) Crew made up as follows: 1 driver and 8 horses on header; 4 wagons with 4 drivers and 8 horses; 1 loader and 2 men at stack.

The cost of stacking is little if any greater than the cost of hauling from shock to the separator when thrashing. Having the grain in stocks ex-

pedites thrashing somewhat and at the same time reduces the number of men and horses required.

*Headers.* — Thousands of acres of wheat are harvested annually by means of the header in the Pacific Coast States and in the Middle West. The sizes of headers most commonly used are 12 and 14 feet. A six-horse team is found most commonly on the twelve-foot machine, although eight horses are sometimes employed where the grain is particularly heavy or where the land is in such condition as to make a very heavy draft. On the fourteen-foot machine eight horses are used most frequently. The approximate cost of harvesting an acre of wheat with twelve and fourteen-foot headers, with two common-size crews each is given in Table IV.

Table IV shows that there is generally a saving in harvesting with a header when the cost of shocking and stacking, or hauling to the separator is considered.

*Combines.* — By far the cheapest method of harvesting and threshing wheat practised in this country at present is by means of the combined harvester, a machine that cuts the heads from the wheat and thrashes them at the same operation.

The use of this outfit has been limited to certain sections where the grain ripens on the stalk.

"Combines" as they are commonly called in the sections where they are used, vary considerably in size and weight according to the type and make. The amount of work done per day with the different sized outfits is shown in Table V.

TABLE V. — *Acres cut and bushels threshed by different sized combines "in a 10 hour day (65 reports).*

Width of combines and horses used	Acres per 10-hour day			Bushels thrashed per day (30 bushel yield)	Usual number of men in crew
	Per combine	Per horse	Per foot of cut		
7 feet, 8 horses . . . . .	12.4	1.55	1.77	372	2
9 feet, 10 horses . . . . .	13.6	1.36	1.51	408	2
12 feet, 22 horses . . . . .	19.9	0.90	1.66	597	4 or 5
14 feet, 24 horses . . . . .	20.6	0.86	1.47	618	5
16 feet, 28 horses . . . . .	27.0	0.96	1.69	810	5
18 feet, 30 horses . . . . .	31.0	1.03	1.72	930	5
20 feet, 30 horses . . . . .	34.0	1.13	1.70	1020	5 or 6
24 feet, 36 horses . . . . .	42.0	1.17	1.75	1260	5 or 6

There is considerable irregularity in the number of acres cut per day by the different sized outfits, due probably to the small number averaged in most of the groups.

Depreciation, interest on investment, repairs, and operating expenses of these outfits are shown in Table VI and VII.

TABLE VI. — *Overhead expenses per year, per day, per acre and per bushel; average cost and estimated life of, and acres cut annually by different sized combines (65 reports).*

Width of swath feet	Average annual overhead expenses on combines				Total per			Average cos	Estim- ated life in years	Average acres cut annually to date
	Total	Depre- ciation	Interest on investment at 6 %	Repairs	Day	Acre	Bushel (30 bushel yield)			
	\$	\$	\$	\$	\$	\$	\$	\$		
7	172.49	106.49	33.00	33.00	9.10	0.734	0.0244	1100	10.33	235
9	184.04	112.04	36.00	36.00	9.30	0.684	0.0228	1200	10.71	269
12	233.36	115.41	50.55	67.40	8.95	0.450	0.0150	1685	14.60	519
14	233.31	114.59	50.88	67.84	9.73	0.472	0.0157	1696	14.80	494
16	209.05	87.95	51.90	69.20	6.58	0.244	0.0081	1730	19.67	858
18	269.37	127.06	60.99	81.32	8.35	0.269	0.0090	2033	16.00	1000
20	310.05	146.25	70.20	93.60	7.93	0.233	0.0078	2340	16.00	1330
24	425.00	250.00	75.00	100.00	8.92	0.213	0.0071	2500	10.00	2000

TABLE VII. — *Labour costs per day, per acre and per bushel for different sized combines and crews, man-labour being considered as worth \$2 and horse-labour \$1.20 per day of 10 hours (65 reports).*

Width of cut and crews most commonly used with each outfit	Labour cost per day			Labour cost per acre			Total man and horse labour cost per bushel
	Total	Man labour	Horse labour	Total	Man labour	Horse labour	
7 feet; 2 men, 8 horses.	\$ 13.60	4.00	9.60	1.10	0.32	0.78	0.0365
9 feet; 2 men, 10 horses.	16.00	4.00	12.00	1.18	0.30	0.88	0.0392
12 feet; 4 men, 22 horses.	34.40	8.00	26.40	1.73	0.40	1.33	0.0576
14 feet; 5 men, 24 horses.	38.80	10.00	28.80	1.88	0.48	1.40	0.0628
16 feet; 5 men, 28 horses.	43.60	10.00	33.60	1.61	0.37	1.24	0.0538
18 feet; 5 men, 30 horses.	46.00	10.00	36.00	1.48	0.32	1.16	0.0495
20 feet; 5 men, 30 horses.	46.00	10.00	36.00	1.35	0.29	1.06	0.0451
24 feet; 6 men, 36 horses.	55.20	12.00	43.20	1.32	0.29	1.03	0.0438

From these figures it appears that the total cost of cutting and threshing a bushel of grain with a combine varies from about 5.1 cents per bushel for the large outfits to a fraction under 8 cents for the 14-foot size. Six cents per bushel is probably a fair general average cost representing one-third and one-fourth of the cost in sections where the wheat is cut and thrashed at two separate operations with a consequent increase in man and horse-labour. At present most combines are still drawn by horses, although auxiliary gasoline engines are frequently used to operate the mechanism, the horses merely moving the outfit. Modern combines are expressly designed and built for the complete operation of cutting and threshing the grain and gasoline engines either in form of tractors or mounted on the combines themselves as single units.

813 — **A Farm Accounting and Statistics Bureau for British Columbia, Canada.** — TWEDDLE, A. B. (Statistician), in *The Agricultural Journal of the Department of Agriculture of Victoria, B. C.*, Vol. 2, No. 10, pp. 197. Victoria, B. C., December, 1917.

The Department of Agriculture of British Columbia, following the example of the Ontario Agricultural College at Guelph, has instituted a Farm Accounting Statistics Bureau for the study of Farm Management, in consideration of the beneficial results similar work has been obtaining in the United States, which proved to be useful not only to farmers themselves but to legislators and colleges as well. It is not intended, nor is it possible at this time, to include all the farmers in the Province, but a limited number will be asked to cooperate with the Department of Agriculture. The necessary diaries and forms will be delivered free of charge to those farmers expressing a willingness to cooperate. In these diaries the farmers will be required to record daily operations and transactions along the lines shown in accompanying forms, which, in brief, relate to crop yields and sales, feed and supplies, fertilizers, live-stock sales and purchases, by-products sales and receipts, expenses of various kinds, capital investment and depreciation, etc. The forms will be distributed merely for the purpose of a guide to the farmers in making entries in the diaries.

The work does not require the knowledge of book-keeping, the farmers being asked to give the simple facts in the diaries. At the end of the twelve months these diaries will be collected by the Department of Agriculture where the data will be compiled.

Such work need not interfere with regular daily duties on the farm, and on the other hand will provide profitable employment for the members of the families for the entire year. All diaries and records will be numbered and so dealt with throughout that during compilation no names will be disclosed to the public, or any member of the Government except the official in charge of the work. Not under any circumstances will the information received by the Department of Agriculture be allowed to be used for any purpose relating to taxation in any form.

Immediately the information has been compiled the diaries will be returned to the farmers, along with a copy of the compiled statements, which may be used for their future reference and guidance.

## AGRICULTURAL INDUSTRIES.

814 — **The Cream of Tartar in Plastered Wines.** — BORNTAEGER, A.: I. Plastered Wines and the (Italian) Official Method for Estimating the Cream of Tartar and the Free Tartaric Acid, in *Le Stazioni sperimentali agrarie italiane*, Vol. I, Pt. 11-12, pp. 576-590, Bibliography of 23 Publications. Modena, 1917. — II. On the Yield in Tartrate of Wines Plastered during Winter, *Ibid.*, pp. 610-612, Bibliography of 19 Publications.

I. — After having given an historical review of the question, quoting the chief work done on the subject since PASREUR, the author describes his own experiments on plastered wines. He has found that the actual yield in cream of tartar during the winter did not agree with the yield calculated by deducting the result obtained in the following spring (March, 1917) from

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the result of the estimation of the bitartrate obtained by the alcohol-ether method carried out in autumn (November, 1916). The actual yield found was higher than that calculated by difference.

II. — Wines made from well ripened, white Vesuvius Catalanesca grapes and plastered on pressing gave a higher yield of cream of tartar (1.25-1.50, 2.10 times) than that given by control wines made at the same time with similar grapes, but not plastered. For the 1913 wines the results were: — natural, 1.00 %; plastered, 1.26 %; another wine plastered more than the previous one, 1.53 %; and for the 1916 wines: — natural, 0.77 %; plastered, 1.63 %.

815 — **The Balance of Some Constituents of the Sugar Beet During the Manufacture of Sugar.** — SAILLARD, EMILE, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 17, pp. 697-699. Paris, April 29, 1918.

On account of the increased price of certain constituents of the sugar beet, especially potassium and nitrogen, the author thought it might prove useful to study these constituents during the process of sugar-making. He gives the results of his investigations as the averages of numerous analyses made during about 15 years, and draws from them the following conclusions.

**NITROGEN.** — The nitrogen from the diffusion pulp and carbonated cake may be recovered, but that which is given off as ammonia during the heating of the juice, syrup and cooked mass, which are alkaline, is lost in the condensation waters or the condenser; this represents about 17 % of the total nitrogen.

At the present time almost all the molasses from sugar factories are used for the manufacture of alcohol and brines (the remainder is used for molasses feeds). The nitrogen they contain, representing about 30 % of that of the beet, is lost during the burning of the residue.

About 50 % of the total nitrogen of the beet is, therefore, lost. This loss is equivalent to 2.2 lb. of nitrogen per metric ton of roots, or about £ 2.10 per acre.

**POTASSIUM AND SODIUM.** — These are contained almost entirely in the molasses and brine. Nevertheless some loss occurs during the burning of the residue.

**PHOSPHORIC ACID.** — This remains chiefly in the carbonated cake.

It is seen that as the beet is converted into molasses, then into residue and brine, the quantity of nitrogen per 100 of potassium decreases. For 100 parts of potassium, the beet contains about 75 of nitrogen; molasses 32, distillation residue a little less than 32.

It was once proposed to absorb the ammonia given off by the heated juices with sulphuric acid; at the present price of nitrogen (4s. 9d. as compared to 11 ½ d. to 1s. 1 ½ d. before the war) this proposal would be more valuable. The loss of nitrogen during the burning of the residue deserves attention for the same reason.

816 — **Estimation of the Water Content of Products of the Sugar Industry by the Distillation Method.**—LINDEN, T. VON DER, KAUFFMAN, M., and LEISTRA, F. (Proefstation voor de Java-Suikerindustrie), in *Archief voor de Suikerindustrie in Nederlandsch-Indië*, No. 22, pp. 951-962 + 6 Tables + 1 Fig. Soerabaja, May, 1917.

Apart from JOSSE's well-known method for determining the water content, and consequently also that in dry matter, in agricultural commercial products, there is another, less exact but more rapid, which has been applied in the analysis of matters differing widely one from the other. This method consists in the *distillation* of the matter to be analysed in the presence of a liquid insoluble in water, such as benzene, toluene, xylene, amyl acetate, paraffin, etc. The steam, carried over with the other vapours is condensed in a eudiometer, thus allowing the water content of the product analysed to be determined immediately. GOGELA applied this method to the analysis of products of the sugar industry in 1915 (*Centralblatt für die Zuckerindustrie*, p. 228, 1915).

The work on this subject is first reviewed, including that of HOFFMAN, the first to apply the method; GRAY, who applied it to the analysis of butter and other foodstuffs, using as insoluble liquid, acetate, valerianate or amyl butyrate; MARCUSSEN (fat, mineral oils, soap and resins); THÖRNER (butter, margarine, meat, milk, vegetables, bread, flour); GRÄFE and SCHWALBE, MAI and RHEINBERGER who used paraffin for fibrous matter and cheeses; FABRIS, with essence of turpentine, for honey; GADTLER, with benzene, for cheese, white of egg, etc.; MICHEL, who made a close study of the method and found that the best results were obtained with a mixture of toluene and xylene as an insoluble liquid.

The authors studied at the Experiment Station of Java the application of this method to the products of the sugar industry and compared their results with those obtained by JOSSE's method. They concluded that:—

1) *With benzene* distillation is too slow, and necessitates the use of too large a quantity of distilled liquid, which remains cloudy; this justifies the opinion of MICHEL, who recommended the use of an insoluble liquid lighter than water and with a higher boiling point.

2) *Paraffin* can hardly be recommended because it causes reactions and then shows too high a water content.

3) *Toluene* gives good results, though it is still necessary to collect excessive quantities of the distilled liquid.

4) *Xylene* is the best liquid; it allows an easy and rapid distillation, and relatively small quantities may be used, According to the author, the mixture of xylene and toluene advised by MICHEL is not appreciably superior to xylene used alone.

Various analyses of molasses made with the use of xylene gave results agreeing with those of other methods so long as certain precautions were taken and corrections made:—1) Readings from the eudiometer a quarter of an hour and an hour after distillation (the average value between the two readings always corresponds best to that obtained by other methods); 2) correction of errors caused by the meniscus of the eudiometer.

The authors do not consider it advisable to adopt this method generally for the analysis of products of the sugar industry, but it gives practical results of sufficient exactitude to be applied now and again, on account of its rapidity, in laboratories where numerous determinations of water content have to be made.

**817 — Bacterial Deterioration of Bread in Rome.** — PEROTTI, R and COMANDUCCI, J., in *Atti della Reale Accademia dei Lincei*, 5th. Series, *Rendiconti, Classe di Scienze Fisiche, Matematiche e Naturali*, Vol. XXVII, Pt. 7, pp. 258-261. Rome, April 7, 1918

In the spring of 1917 a ropiness was observed in the bread of some bakeries in Rome which was attributed by the authors to a form resembling *Bacillus mesentericus vulgatus* Flügge, perhaps identical with VOGEL's *Bacterium mesentericum*, and differing slightly from FÜHRMANN's *Bacterium panis*. The chief condition under which this deterioration occurs is the chemical composition of the flour. The agent, at least in the case studied by the author, is infected yeast. To avoid the injury it is necessary to disinfect the vessels and the rooms in which infection has occurred, use controlled, well-prepared yeast, and keep the bread at a rather low temperature.

With reference to another deterioration of bread caused by *Oospora variabilis* and studied by one of them (1), the authors note that the organism survives baking much more frequently than had been supposed, and that this must be borne in mind, not only to obtain good bread, but also to prevent the spread of organisms of infectious diseases.

**818 — The Agen Plums and Prunes.** — CARLES, P., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 13, pp. 429-432. Paris, April 10, 1918.

The author (fellow of the Faculty of Medicine and Pharmacy of Bordeaux) summarises a pamphlet published by him under the title of "*The Agen Plum and Prunes*". In the preparation of the Agen prune there are four chief points for the biologist to consider:— 1) the destruction of the relative tartness of the ripe fruit; 2) its desiccation; 3) elimination of moulds; 4) constant preservation of its normal water content.

**1st. Phase.** — The action is exclusively *chemical* or, more correctly, *biological*. The agent is an oxydase which, when helped by gentle heat and a moisture-saturated environment, quickly destroys the tannic matter ferrous salts, etc., and changes the fruit juice into a very delicately flavoured and sweet juice.

**2nd. Phase.** — This is purely *physical* and consists of the transformation of the juice into a true syrup by the elimination of its excessive water. To do this the temperature is gradually and regularly raised while a drying air current is set in motion. The process must be stopped at the moment when the remaining sugar transforms this intracellular juice into an ordinary preserving agent, an auto-antiseptic. The prune is ready when the natural moisture is thus reduced to 30 %.

**3rd. Phase.** — These are various methods of eliminating moulds and the author discusses their scientific side.

(1) See R. Sept., 1917, No. 852. (Ed.)



*4th. Phase.* — Dryness must be avoided. When, to eliminate the danger from moulds, the 30 % moisture content is by chance allowed to fall too low the sugar of the normal syrup crystallises on the surface. The fruit turns first grey, then white, like figs, and loses its plasticity, delicate flavour and 50 % of its commercial value. If the sterilised prune with its normal water content is placed where the water cannot evaporate, it will keep its qualities indefinitely. It is yet better to pass a well-adjusted supply of hot steam into a store where evaporation is very slow ; by this means the moisture equilibrium is re-established and the prune assumes the black colour characteristic of its normal water content.

Producers, buyers and exporters should give greater attention to selecting varieties instead of sacrificing all else for the weight of the fruit. Weight is far from being a definite proof of the excellent quality of certain plums with small, light yellow stones and greenish-yellow flesh of average volume. The smell of these varieties is so pervasive, yet so delicate, that when the fruit is eaten the smell spreads all around.

**819 - The Pasteurization of Sour, Farm-skimmed Cream for Buttermaking.** — HUNZIKER, O. F., SPITZER, MILLS, H. C. and SWITZER, H. B., in *Purdue University, Agricultural Experiment Station, Bulletin* No 208, Vol. XX, pp. 76, 54 Tables, Lafayette, Ind., September, 1917.

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The purpose of the experiments recorded in this bulletin was :—

- 1) To determine the effect of pasteurization of sour, farm separator cream on the flavour, keeping quality and market value of butter.
- 2) To study the effect of different processes of pasteurization on the bacterial count of cream and butter and on the flavour and keeping quality of butter.
- 3) To study the effect of pasteurization on the chemical properties of fresh and stored butter.
4. To determine the causes undertaking the changes of the flavour of raw and pasteurized cream butter in storage.

The results are summarized as follows :—

Fresh butter made from sour cream pasteurized at 145° F. and held for 20 minutes, scored 2.9 points higher than fresh butter made from raw sour cream. Fresh butter made from sour cream pasteurized at 165° F. flash and at 185° F. flash respectively, scored practically the same as fresh butter made from raw sour cream.

After 30 days cold storage, the butter made from sour cream pasteurized at 145° F. holding, and 165° F. and 185° F. flash process, scored 3.9 points, 2.0 points and 2.4 points higher, respectively, than the butter made from raw sour cream.

After 90 days storage, the pasteurized cream butter scored 4.5 points, 2.9 points and 3.2 points, respectively, higher than butter made from raw cream.

On the basis of a difference of two cents between extras and firsts, and two cents between firsts and seconds, and assuming that extras are worth 30 cents, the holding process butter would sell at 1.6 cents, 1.7 cents, 1.7 cents and 2.0 cents higher when fresh and when 30, 60 and 90 days old, res-

pectively, than the raw cream butter. On the same basis, butter from the flash process at 185°F. would sell at 0.2 cent, 0.9 cent, 1.1 cents and 1.3 cents higher when fresh and when 30, 60 and 90 days old, respectively, than raw cream butter.

The holding process at 145° F. for 20 minutes proved more efficient in its germ killing effect than either of the two flash processes, averaging a germ killing efficiency of over 99.9 per cent. The flash process at 185°F. showed a slightly lower germ killing efficiency than the holding process, and the 165°F. flash process had a germ killing efficiency of not more than 90 per cent. The minimum temperature and time at which the holding process insures maximum germ killing efficiency and keeping quality is 145° F. for 20 minutes. Nothing is gained by longer exposure to 145°F.; in fact, excessive exposure is undesirable, because it tends to give the butter a mealy body.

The butter made from cream pasteurized at 185° F. flash showed the best keeping quality. This is probably due to its power, not only to destroy germs, but also to inhibit the action of enzymes.

The 185° F. flash process proved unsuitable for pasteurization of sour cream, causing the butter to have a distinctly oily flavor. This appears to be due to the combined action of high heat and high acid. In the case of sweet cream or sour cream in which the acid has been properly reduced by neutralization before pasteurization this oily flavor is much less pronounced.

The germ killing efficiency of pasteurization in summer is greater and the keeping quality of such butter is better than that of winter cream and butter showing that winter cream contains more resistant and undesirable ferments than summer cream.

The quality and sweetness of cream affect both raw and pasteurized cream butter, but pasteurization is capable of producing marked improvement in the quality of butter even from inferior cream.

In order to reap the full benefit of pasteurization, cream and butter must be guarded against re-contamination after pasteurization. An unclean vat may reduce the efficiency of pasteurization 50 per cent. Pure air, sanitary condition of sewers, freedom of the factory from flies, cleanliness of vats, pipes, conduits, coolers and churns, purity of starter and wash water, and the sanitary condition of the packing equipment are all essential in safeguarding the benefits of pasteurization.

When cream is put in proper condition for pasteurization, and other conditions are as they should be, there is no danger of excessive loss of fat in the buttermilk from pasteurized cream. Pasteurization of mixed sweet and sour cream without giving the acid in the sour cream time to act normally on the curd in the sweet cream, pasteurization of excessively thin sour cream, the churning at too high temperatures or not holding the cream long enough at the churning temperature, and the overcrowding of the churn, are bound to reduce the exhaustiveness of the churning and to cause heavy loss of fat in the buttermilk.

Pasteurization does not materially effect the chemical composition of butter. It has a tendency, however, to lower slightly the per cent moisture

curd and acid in butter. During storage, the per cent. lactose in butter decreases and the acidity increases. These changes are greater in raw cream butter than in pasteurized cream butter. The increase in acidity is not proportionate to the decrease in lactose. The fat constants in butter in storage undergo but very slight changes. These changes are greater in raw cream butter than in pasteurized cream butter, but they are too far within the limits of experimental error to permit of serious comparison. The fat constants in butter fat held at room temperature for 11 months showed slightly greater changes, but even these changes were in no way commensurate with the intense deterioration of the flavour of the fat. These results suggest the probability that some of the flavour defects in storage butter may be due, at least in part, to hydrolysis or oxidation of some of the fats and that very slight changes in the fat constants may create most intense depreciation in the flavour of butter fat and butter.

All butter held in cold storage showed an increase of cleavage products of the proteins as determined by proteins not precipitated by bromine, copper sulphate, phosphotungstic and tannic acid. This increase in protein decomposition was much more rapid after butter had been transferred from cold storage to room temperature. The protein decomposition was greatest in the raw cream butter and least in the butter made from cream pasteurized at 185°F. flash process, showing that this process proved most efficient in retarding protein hydrolysis, probably due to its power to destroy the activity of enzymes contained in cream. Protein hydrolysis in butter may be brought about by such agents as ferments, both micro-organisms and enzymes, acids, salts and metals through catalytic action. Cream of poor quality and old cream furnish favourable conditions for rapid protein hydrolysis in butter. Protein hydrolysis plays a prominent part in the deterioration of butter in storage. It can be minimized by improving the quality of the cream, proper pasteurization, reduction of acidity, discarding of rusty cans, protection of cream and butter against contamination with metals and metallic salts, sanitary equipment, thorough washing of the butter, proper treatment of liners and wrappers, cleanliness of packing and printing equipment and guarding butter against exposure to high temperatures in storage and in transit.

**820 - A Substitute for Rennet Extracted from the Berries of *Solanum eleagnifolium*.** — See No. 745 of this *Review*.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

#### GENERAL

821 - Sooty Moulds of Southern France. — ARNAUD, G., in the *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Part 2, p. 95. Paris, 1917.

The author gives the results of his observations on sooty moulds collected by M. MAZADE at Mougins (Alpes Maritimes), etc., in March, 1915.

On branches of olive attacked by *Lecanium oleae* were perithecia of *Capnodium meridionale*, already reported on various plants.

Branches of fig heavily attacked by *Ceroplastes rusci* were covered with numerous perithecia of *Ceratocarpia Cactorum*; the same fungus was also very abundant on the branches and less commonly on the leaves of the orange tree. The latter plant was chiefly attacked by *Lecanium hesperidum* with a few *Pulvinaria camellicola*. Up to the present the fungus had never been reported on the leaves.

The perithecia of the two species in question were often accompanied by the pycnidia and elongated spermagonia found in the majority of the sooty moulds.

This information shows that the sooty mould fungi are not in close relation with any particular species of plant or honeydew-producing insect.

#### MEANS OF PREVENTION AND CONTROL

822 - Simple Solutions of Copper Sulphate against Vine Mildew. — CAMPREDON D'ALBARETTO, E., in *Annali della R Accademia d'Agricoltura di Torino*, Vol. XI, (1917), pp. 13-19. Turin, 1918.

At Ponzano Monferrato (province of Alexandria) the author carried out spraying experiments to compare the action and efficiency of Bordeaux mixture containing 1 % copper sulphate and 1 % lime with those of a simple solution of copper sulphate containing 250 gm. of sulphate per hectolitre of water and made adhesive by the addition of 500 gm. of dextrin previously dissolved in hot water. The results showed that simple 2.5 % solutions of copper sulphate are more efficient and act more rapidly than those of Bordeaux mixture. Nevertheless, even when dextrin is added to these simple solutions to make them more adhesive and to increase the duration of their action, this action decreases rapidly and a few days after spraying the vines have as low a resistance to adverse conditions and attacks of mildew as those treated with ordinary Bordeaux mixture.

Simple 2 % solutions can, therefore, be used as a rapid cure, but Bordeaux mixtures containing 1 % copper sulphate and 1 % lime have a more lasting and more certain preventative action.

From these results the author deducts the following practical rules:—

Simple solutions are not to be recommended in the ordinary control of mildew because of the short duration of their action, which though very effective immediately after spraying, weakens rapidly and disappears in a few days, leaving the vines unprotected. They should only be used in exceptional cases, especially for treating large vine-growing areas when mildew appears suddenly and labour is lacking, as they rapidly check the attack. Once infection has been stopped by easy and economical spraying with a simple solution there is ample time to spray again with Bordeaux mixture, the application of which is slower and more expensive, the curative action slower, but more lasting and capable of protecting the vine against subsequent attacks of the disease.

823 — Patents for the Control of Diseases and Pests of Plants. — See No. 809 of this *Review*.

824 — Diseases and Pests of Sorghum in Kansas, U. S. A. — See No. 760 of this *Review*.

DISEASES  
OF VARIOUS  
CROPS

825 — Diseases of Parsnips in England. — CORTON, A. D., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 1, pp. 8-21 + 2 Figs + 2 Plates. London, 1918.

The attention of the Board of Agriculture and Fisheries was recently drawn to a disease of the roots of parsnips (*Pastinaca sativa* = *Peucedanum sativum*) well known to English farmers as "parsnip canker", or "parsnip rust". This disease does not appear to have been studied hitherto.

The very serious loss in roots, especially in Worcestershire, and also in Gloucestershire and Somersetshire, lead to a careful investigation. Two visits were paid to the district most affected (that of Evesham, Worcestershire). Besides field observations, experiments were made at Kew with diseased roots and infected soil from Evesham and Somersetshire. At the same time certain secondary diseases of the parsnip were noted, three of which are new for Great Britain, and one of which appears capable of causing serious damage.

Parsnip canker, *i. e.*, the decay of the upper part of the roots during late summer and autumn, is caused by a physiological phenomenon which cracks the outer skin, and not by invasion by a parasitic fungus. The cracks occur during growth, especially when heavy rain follows a period of drought; the parts attacked are the periderm and the outer layers of the cortex. The cracks, mainly horizontal round the upper part of the root but also vertical, are from  $\frac{1}{2}$  to 2 inches long, and expose the cortex. The resulting canker or decay is caused by the inability of the root to form a layer of wound cork. Although the outer cortical cells exposed to the air suberise and there are but few cell divisions, no definite phellogen is formed and the cracks are not protected as in the case of other fleshy roots. The protection is insufficient to keep out micro-organisms, which probably

enter by the inter-cellular spaces and cracks caused by drying and destroy the tissues of the root more or less rapidly. Although canker is more serious in some districts than others, it seems to occur everywhere as a result of the cracking of the root-skin. No specific microorganism has been isolated in connection with this decay.

With respect to the conditions causing the formation of cracks, investigations show that while these cracks are due to an unequal rate of growth of the tissues — the inner tissues growing more rapidly than the outer ones — and are largely influenced by weather conditions, their formation may be favoured by certain methods of culture, chiefly overmanuring, neglect of liming and early sowing, which causes premature ripening. The variety of parsnip grown may also be responsible for the appearance of the disease, a high quality parsnip with bulky top, abundant flesh, and small core being very largely grown in the worst infected areas.

As preventative treatment it is advisable:— 1) to avoid growing parsnips in too rich a soil 2) to sow late, 3) not to neglect liming, 4) to apply potash and salt to the soil to retard ripening, 5) to adopt a suitable rotation, never growing parsnips two or three consecutive years on the same land.

Besides canker, parsnips are attacked by the following diseases:

1) *Erysiphe Polygoni* D. C., a fungus occurring in large numbers in market gardens round Evesham and Wisbech, and elsewhere; the attack is not sufficiently severe to call for special treatment.

2) *Phyllachora Pastinacae* Rostr.; a species new to Britain; the conidial form (*Cylindrosporium Pastinacae* Lind.) attacked very severely the foliage of a certain number of parsnips in a market garden at Mickleton (Glos.). Although neither the ascigerous nor conidial stage of *Phyll. Pastinacae* had been previously reported in the country, there is little doubt that it occurs frequently but has been overlooked. It is also probable that *Phyll. Pastinacae* is synonymous with *Phyll. Heraclei*, a fungus not uncommon in England on cow parsnip, *Heracleum Sphondylium*. There is no doubt that the parasite passed from the wild to the cultivated plant.

3) *Ramularia Pastinacae* Bubák, new to Great Britain, found on parsnip leaves generally in Worcestershire, but also in Gloucestershire and Cambridgeshire. It is probably spread widely over England, but has been overlooked. In crowded gardens and allotments the fungus weakened the plants considerably, but in the open fields the damage was insignificant.

4) *Cercospora Pastinacae* Karst., new to Great Britain; found on parsnip leaves closely associated with *Ramularia Pastinacae*, but much less common than this fungus.

5) *Plasmopara nivea* Schroet., a species observed in large numbers on parsnip leaves near Wisbech at the end of September, 1917. In October it was found on material from Ashford and Haslemere, and later signs of its presence were noted in several other localities. In a garden near Wisbech where parsnips were grown between trees a considerable amount of the foliage was destroyed by this fungus.

826 - The Control of a Disease of the Japanese Medlar caused by *Fusicladium pirinum* var. *Eriobotryae* (1). — SAVASTANO, L., in the *R. Stazione di Agrumicoltura e Frutticoltura, Acireale, Bollettino* No. 33, pp. 2. Acireale, 1918.

In 1917-18, the experiments with lime-sulphur mixture, begun in 1916 to attempt to control the disease (called "brusone" by the author) were continued.

Summer sprayings were tried, with the object of controlling the disease in the branches, as well as 2 winter sprayings for the purpose of protecting the medlars from the parasite.

As the result of these experiments, the following method is advised for the treatment of the disease:—

1) Summer spraying: in August, with 10-12 % lime-sulphur mixture, normal density 1.25; this spraying is only given when the disease is present in the branches.

2) Winter sprayings. The first at the end of December or beginning of January, *i. e.*, when the disease begins to appear, and the second in February; both of 12 %, normal density.

The spray should be applied liberally so as to wash the vegetative parts requiring protection against the fungus.

827 — Larch Canker (*Dasyscypha Willkommii*) in Sweden. — See No. 771 of this Review.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

828 - The Value of the Coleopteron *Chilocorus bipustulatus* as a Destroyer of Scale Insects (1). — CORTE, J., in *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Pl. 2, pp. 86-88, Paris, 1917.

The author collected notes on the attack of the ladybird *Chilocorus bipustulatus* L. on the scale insect *Chrysomphalus dictyospermi* Morg., which is becoming a serious pest in eastern Provence on account of the swarms in which it occurs. His observations do not agree with those of TRABUT, according to whom the ladybird, in Algeria, attacks nearly all scale insects, especially *Ceroplastes rusci* L. of the fig tree, and is able to prevent *Aspidiotus hederae* Vallot from ruining the carob crops.

The author first observed *Chilocorus* larvae and adults feeding on *Chrysomphalus dictyospermi* on a mandarin tree in a garden at Nice, as well as on a neighbouring orange tree. In another garden near the same species was found on a clump of rose-bay the leaves of which were covered with the scale. The research included direct observation and breeding of the insect. Direct observations could only be made during July and were frequently interrupted. During this time *Chil. bipustulatus* was the only coccinellid observed on the mandarin tree and continued to live on it. *Toxoptera aurantii* Fonsc. attempted to invade the bush several times; very small colonies of the aphid formed at the extremities of the twigs,

MEANS  
OF PREVENTION  
AND CONTROL

(1) See R., May, 1918, No. 599. — (2) See B. Apr., 1915, Nos. 451 and 452; B. March, 1916, No. 368; R. June, 1916, No. 707; R. Oct., 1916, No. 1140, R. July, 1917, No. 691; R. Jan., 1918, No. 118. (Ed.)

under the very young leaves which curved round them. These small colonies were destroyed as soon as they appeared, not one being able to establish itself on the tree under observation. The author was unable to catch the ladybird in the act of destroying the insect, but the relative abundance of *Chilocorus* on the bush and the absence of any other coccinellid seem to leave no doubt that the destruction was due to this coleopteron.

If this be correct it shows that the scale is not the food preferred by the ladybird, which only attacks *Crysomphalus* when its customary food is lacking. Nevertheless *Chilocorus* is not considered a large eater of aphids. On the other hand there were on the mandarin tree some specimens of *Saissetia oleae* Bern. in various stages of development, but none appeared to be attacked. The same thing applies to some *Pseudococcus adonidum* (L.) Westw. which the author brought into contact with the ladybird, which seemed to ignore them. It was also noted that *Chrysomphalus* multiplied actively on the mandarin tree and rose-bay under observation, especially on the bay, in spite of the many ladybirds on them.

The author placed four specimens of *Chilocorus* in a large tube and fed them with rose-bay leaves on which were *Chrysomphalus*. With the help of a magnifying glass it was easy to see how the ladybirds attacked the scale insects. They attack the edge of the shield, break it, and feed on the exposed body of the female. Sometimes the *Chilocorus* specimens were not fed for two or three days. Under these conditions they were seen on one occasion to make vain attempts to break the edge of the shield of large *Ceroplastes sinensis* Del Guercio, which they would certainly not have touched had they not been starving. On the other hand, some weeks later, young *Ceroplastes* mixed with *Chrysomphalus* were continually left untouched in spite of their thin shields. This also happened in the case of young *Ps. adonidum* but *Asp. hederae* was found to be a very acceptable food.

The observations, started during the first fortnight of July, were still being continued during the beginning of December, when two of the ladybirds died and the appetites of the two others decreased considerably. After the end of December they only received scale insects on ivy, and died in the middle of April.

The direct observations and breeding tests therefore proved that, in the Nice district, *Chil. bipustulatus* attacks *Chrys. dictyospermi*, which suffices to keep it in normal condition, but does not appear to be its normal food. Agriculturists cannot rely on *Chil. bipustulatus* for the efficient control of swarms of *Chrys. dictyospermi*.

829—The Toxicity to Insects of Various Organic Compounds. — See No. 771 of this Review.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

830 — *Dysdercus scassellatii* n. sp., a Bug Observed on Cotton in Southern Italian Somaliland. — DEL GUERCIO, G., in *L'Agricoltura coloniale*, Year XII, 1st. Half-Year, No. 1, pp. 5-20, 6 Figs. Florence, 1918.

A detailed morphological description of the new species *Dysdercus scassellatii* (Hemiptera Heteroptera), collected on cotton in southern Italian Somaliland by Dr. G. SCASSELLATI-SPORZOLINI.



Up to the present there has been no precise information as to the biology of the hemipteron.

In some nymphs of this *Dysdercus* some unidentified forms of mycetozoa have been found, as well as two different bacteria not yet identified. No internal parasite was found in the nymphs and adults examined.

Together with the nymphs were sent rare forms of large spiders, regarding whose importance, according to the author, nothing definite can be said.

831 — *Megastigmus ballestrerii*, a Hymenopteron Living on the Pistachio Tree and Turpentine Tree, in Sicily. — DE STEFANI, T., in the *Bollettino di studi ed informazioni del R. Giardino coloniale di Palermo*, Vol. IV, Pt. 1-2, pp. 101-131 + 24 Figs. Palermo, 1917.

After reviewing the various insect and arachnid pests attacking the pistachio tree (*Pistacia vera*) and turpentine tree (*P. Terebinthus*, used not only a stock, but also for fertilising the pistachio) in Sicily, the author confines himself more particularly to the chalcid *Megastigmus ballestrerii* Rond. (syn. *Trogocarpus ballestrerii* Rond.).

The larva of this insect, called by the author "verme dei frutti del pistacchio", destroys the pistacchio seed. In 1916 more than 70 % of the fruit were lost by the action of *M. ballestrerii* in some plantations.

The morphology of the insect is minutely described and information on its biology and habits given. The author believes its natural host to be the turpentine tree, and that it has gradually adapted itself to the pistachio.

The best method of controlling *M. ballestrerii* is to collect carefully and burn all infected pistachio fruit either on the plant or on the ground; such fruit is easily recognisable.

To prevent contamination the same procedure should be applied to the fruit of all turpentine trees in or near pistachio plantations. As the collection of the small turpentine fruit from the tree and the ground would be very difficult, the author recommends the destruction of the female inflorescences in April and May as a quicker and more certain method.

[830-831]



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

## INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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FIRST PART.

### ORIGINAL ARTICLES

#### **Mechanical Ploughing. Handling of the Machines.**

BY

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At present the use of machinery for ploughing is spreading so rapidly, especially in France, Great Britain and Italy, that it will be necessary to modify the usual methods of cultivating the soil in such a way as to utilise the machines in the best possible manner.

This modification is all the more necessary in Italy since the greater number of the machines had to be hastily — and consequently not always so carefully as was desirable — ordered from the United States, a country having different soil conditions and methods of cultivation, as well as of purchase and use of the machines.

Unfortunately, on the contrary, many farmers, obstinately clinging to the old customs or slaves of routine, thought they could simply use the machine to replace the ordinary plough, thus obtaining an unsatisfactory yield of work, imperfect ploughing, and sometimes running the risk of having unpleasant surprises while the work was in progress.

However, it must be admitted that, though much progress has been made in the construction of machines for motorculture, and though there is an abundance of publications dealing with the subject, yet very little attention has been paid to practical instruction on their application to the soil, except for a few publications by experts dealing with special aspects of the vast problem (1) and for pamphlets and catalogues — not always disinterested — published by the makers of such machines.

(1) For example, see the articles by Prof RINGELMANN in the *Journal d'Agriculture pratique*, 1916, p 135 and 1917, p 103

It is, therefore, not surprising that, owing to lack of more complete and detailed information, farmers are perplexed when about to buy new machines, or are embarrassed when using them on the farm.

The present notes are intended to provide new material for the study of this important question, by considering a series of data and practical rules concerning the new technique of cultivation.

A description will be first given of the handling of the machines in the field, following by a more detailed consideration of the way they should be used in ploughing according to the various methods of preparing the soil.

Leaving aside balance machines (with cable or direct traction), the handling of which is reduced to engaging and lifting out the ploughs at the beginning and end of each furrow, only motor ploughs and tractors will be considered, as their handling is much more complicated, both during the work (ploughs in the soil) or when the ploughs are lifted.

**HANDLING DURING WORK.** — It is very easy to guide the machine during ploughing when the furrow is rectilinear, but it must be very straight. For this reason the first furrow should be turned most carefully with a team, for the perfection and easy working of all the following furrows depends on its straightness.

Handling becomes much more complicated when the furrow is curved. Let us take the example of a tractor with one driving wheel working in the furrow (Fig. 1).

The coupling  $\gamma$ , usually attached at about the middle  $a$  of the back-axle, can turn round this point, describing an arc of radius  $r$  (length of coupling). When the tractor turns, describing an arc of radius  $R$ , the chain and, consequently, the plough-beam, should take up the position  $ac$ , in order that the width ploughed should remain constant. On the contrary, however, owing to the pull being on a curve the chain tends to assume the position  $ac_1$  (normal to  $R_1$ ), so that there is a tendency for the ploughs to be displaced towards the centre  $O$  of the curve.

This tendency, whilst hindering the steering by causing a lateral com-

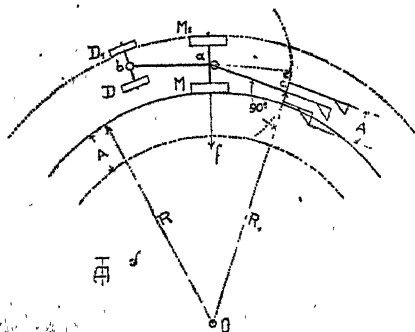


Fig. 1 — Ploughing on a curve with a tractor with one driving wheel running in the furrow.

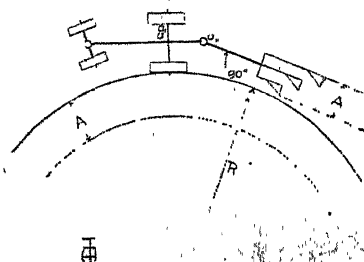


Fig. 2 — Ploughing on a curve with a tractor with one driving wheel; effect of moving the coupling to  $a_1$ .

ponent  $f$  to act on the driving wheels which causes the rear wheels of the tractor to be displaced transversely to the direction of movement, prevents the ploughing of a uniform width, as the ploughs tend to be displaced towards the ground already ploughed and to enter into the preceding furrows, while the displacement is all the greater as the chain  $r$  is the longer and the turning radius  $R$  is shorter.

When the point where the chain (Fig. 2) is attached is moved to  $a$ , or as far as  $a''$ , (as is done for hauling military lorries on the road), the difficulty is lessened, but not eliminated, for such a displacement should vary with the radius of the curve (1).

This difficulty is also not eliminated when ploughing on an *internal* curve, i. e., when the driving wheel  $M_1$  runs in the furrow. In this case the ploughs tend to move away from the ploughed land, thus covering a larger width and leaving strips unploughed.

This disadvantage is less noticeable with machines of the *MOLINE* type (front driving wheel) or with motor-ploughs of the *PAVESI-TOLOTTI* type.

With machines working, not in the furrow, but on the firm land, there is no difficulty in ploughing external curves, because their freedom of movement on the soil allows of the ploughs being guided into the correct position; on the other hand, the disadvantage is accentuated when working on an internal curve, the steering wheel  $D$  being obliged to run on the ploughed ground.

In any case ploughing curves is always very difficult, and results in a poor yield being obtained from the engine on account of the greater passive resistance, while the machine (even with a differential) wears more owing to the abnormal strain on gears and bearings. Work done on such curves can never be regular or perfect.

It can be easily understood why circular ploughing is often practised in North America (the *FELLENBERG* method and its modifications) on account of the usually light soils and the fact that a depth greater than 5 to 6 in. is rarely ploughed. The regularity of the work in this case becomes merely a side-issue when compared with the benefit obtained by eliminating turning at the end of the furrows, the ploughing thus being continuous.

But, in Italy the more intensive cultivation, which requires better and deeper ploughing, the more compact soils, and the absence of vast plains, indicate the inadvisability of curvilinear ploughing, which should be reserved for indispensable work such as finishing off the corners of the field.

For example, let us assume that a corner of a field, forming an acute angle (Fig. 3), to take a simple case, has to be finished. It should be finished on a curve of the shortest radius compatible with the turning of the

(1) Theoretically, the constance of the relative positions of the (rigid) coupling and the beam can be obtained for any turn by making them both of the same length, or by using a double (rigid) coupling crossed X-wise. In practice, however, this is not easy, on account of constructional difficulties and even of the ploughing, especially with gang-ploughs.

machine, *i e.*, along the curve *acb* (shown as an arc to simplify matters) so as to reduce to a minimum the space *Oacb* which has to be left to be finished by hand. But this is not possible because, whether working on internal or external curves there would be unploughed strips on the curves, given that the widths *L* of the first furrow are so much greater than the normal width *l* as the angle of the field is more acute.

The ploughing must, therefore, be done in *concentric* curves (Fig. 4); the part of the angle left untouched will, it is true, be greater, but the rest will be completely and uniformly ploughed.

The attention of the drivers should be drawn to this simple fact, especially when they wish to close the furrows by proceeding from the exterior to the interior of the field (as is done in rice fields where the golden rule is to heap the soil against the banks that surround the field, so as to strengthen them), in order that they may not open the first furrow with the maximum turn, then find that they cannot turn symmetrically on the curves of the subsequent furrows.

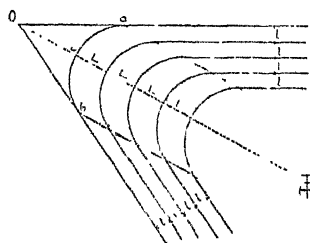


Fig. 3 — Ploughing a corner of a field, bad method.

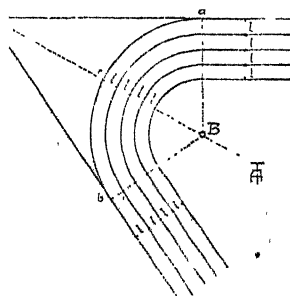


Fig. 4 — Ploughing a corner of a field, good method.

**HANDLING WITH THE PLOUGHS LIFTED.** — Handling with the ploughs lifted is much lighter and easier than during ploughing, but it is much more frequent, particularly when there are short furrows or irregular plots, so they they tire the driver the most. From this point of view, they thus deserve special consideration.

Turning is easier with 2 steering wheels mounted on a loose axle, turning like the front-wheels of an ordinary four-wheeled cart. It is less easy when the 2 wheels are turned as in the automobile type, and still less easy when there is only one steering wheel. In the last two cases turning on the spot is very tiring if the tyres of the wheels are very prominent and it is almost impossible on very compact soils.

The turning should, therefore, be done while moving, and gradually, without pushing the turn to the maximum, for handling is nearly always more tiring on narrow curves; but, on the other hand, it should be done energetically and so, as to save time (thus obtaining more work).

and a smaller consumption of fuel) and space (smaller breadth of the headlands).

It is thus of interest to see how the machine can be handled in the field, while conciliating the opposite requirements of less fatigue with greater speed, in the narrowest space.

When it is said that a machine *turns* in a radius, of 5 metres for example, it means that the machine can, at the maximum, turn in a circle of 10 metres in diameter, but not that it could do the whole turn in a space of 10 metres except by doing the maximum turn *on the spot*, which never happens in practice.

For example, take a machine moving along a straight line  $AB$  (Fig. 5) and which, when at  $B$ , should turn to the right. The driver, letting the machine move forward, commences to turn gradually towards  $C$ , the maximum turning point, after which the machine would advance automatically, describing an infinite number of circles of centre  $O$  and radius  $OC$  corresponding to the minimum possible to the machine. The trajectory  $BC$  of the machine is evidently a polar curve, for, supposing that the turning could increase still more after the point  $C$ , the radius of curvature would be reduced to zero, *i. e.*, would attain the pole; the amplitude or development of the trajectory in the field depends, for the abscissae  $BD$  and the ordonates  $CD$ , on the ratio between the two speeds of advancing and turning (1) simultaneously.

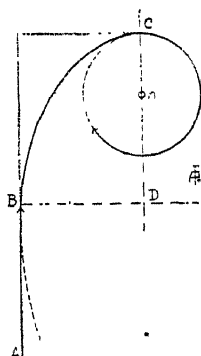


Fig. 5 — Mathematical analysis of a turn.

If this ratio is constant, *i. e.*, if the machine moves forward uniformly and if it turns gradually, as in the cases when it would be obtained mechanically with a uniform movement, then the curve has a well defined equation: that of the logarithmic spiral, as is shown by the mathematical analysis.

Figures 6 to 16 represent by one of these spirals (the same in each figure, and on the same scale), a few of the commonest evolutions carried out in the field by tractor ploughs (usually with ploughs turning the earth on one side only), in order to compare the length covered (space covered as a function of time employed, and, consequently, of fuel consumed) and the total amplitude of the turnings (sum of work or effort expended by the driver).

These figures show the form of the evolutions, *carried out with constant speed in the minimum space*, given: — *a*) the maximum width of a headland, or the space in which the evolutions must take place included between the lines  $xx$  (end of the furrows) and  $yy$  (edge of the field) (Fig. 6); *b*) as unit  $P$  of effort, making a complete turn (to pass from  $B$  to  $C$ , Fig. 5);

(1) In Fig. 5,  $B$  is a point of the curve placed so that the tangents at  $B$  and  $C$  are normal to one another; this is an example of one of the commonest practical applications. But  $B$  could also be placed either above or below the line  $BD$ .

c) as unit  $S$  of space, the corresponding trajectory, that is, the length of the spiral  $BC$ .

*Minimum turn with curve of  $180^\circ$ , or half-circle turn (Fig. 6).* — When the last plough is about to reach the line  $xx$  at  $A$  (end of furrows) the steering wheels have reached  $B$ , where the turn to the right, for example, commences. Once the maximum turn has been reached at  $C$ , the driver begins to turn to the left until the machine reaches  $D$ , afterwards starting the return trip at  $A_1$ . *Total journey =  $2 S$ ; total work =  $2 P$ .*

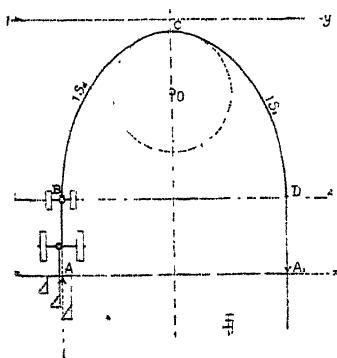


Fig. 6 — Minimum turn at  $180^\circ$

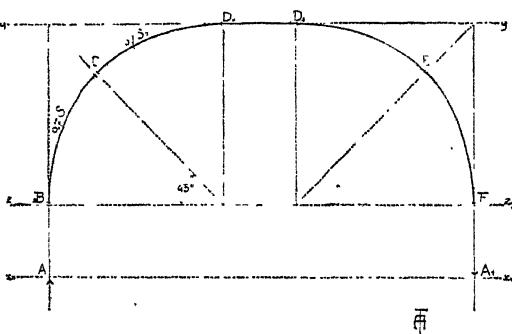


Fig. 7 — Minimum turn at  $90^\circ$  repeated.

*Minimum turn with curve of  $90^\circ$  (Fig. 7).* — To reach half the turn (angle of  $45^\circ$ ) at  $C$  the machine had to turn about  $\frac{1}{4}$  to the right, travelling a distance of  $0.7 \times S$ ; it has to turn the same distance to arrive at  $D$ . *Total journey =  $1.4 S$ ; total work =  $1.4 P$ .* This turn usually serves to fix the breadth of the chief headland.

If it is desired to return to the furrows (turn of  $180^\circ$ ) from  $D$  (or from

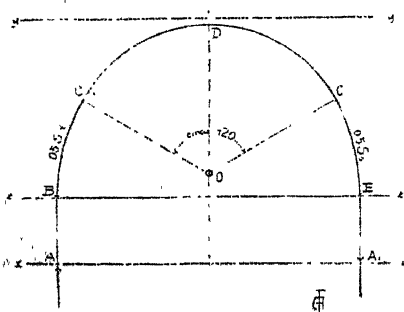


Fig. 8 — Circle of  $180^\circ$  with minimum turn.

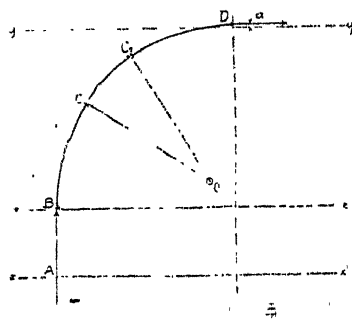


Fig. 9 — Manoeuvre for decreasing the turning.



$D_1$ , after a rectilinear journey along the edge of the field), the same manœuvre must be repeated, *i. e.*, that  $D_1E$  = about  $\frac{3}{4}$  of the right-hand turn, and  $EF$  = about  $\frac{3}{4}$  of the left-hand turn. *Total journey* =  $2.8S + DD_1$ ; *total work* =  $2.8P$ .

*Curve of 180° with minimum turn* (Fig. 8). — From  $B$  to  $C$ , half-turn

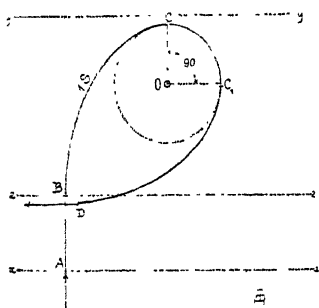


Fig. 10 — Orthogonal turn.

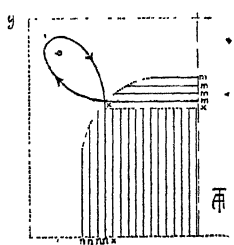


Fig. 11 — Finishing work on a curve of two headlands with orthogonal turns.

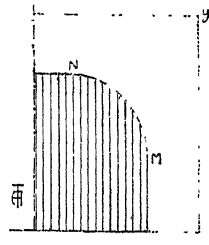


Fig. 12 — Method of ploughing without headlands, eliminating orthogonal turns.

to right; from  $C$  to  $C_1$ , arc of circle (without turning manœuvre) of centre  $O$ , angle about  $120^\circ$  and length about  $1.75S$ ; from  $C_1$  to  $E$ , half-turn to right to straighten out. *Total journey* =  $2.75S$ ; *total work* =  $1P(1)$ .

These results show that the turns should be kept within the limits of Figs. 6 and 8 (*i. e.*, between 5 and 8 metres with the ordinary American

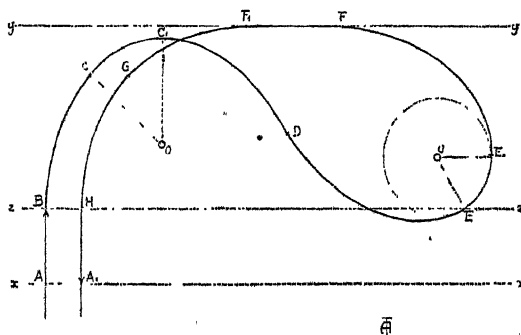


Fig. 13 — Double turn within the breadth of an ordinary headland.

machines) and that it is a mistake to think that very wide ridges (as in Fig. 7) save the driver trouble; he certainly has an period of rest (in the journey  $DD_1$ ) but there is waste of both time and fuel, while the fatigue caused

(1) In the case of Fig. 7, the turning curve can be diminished as shown in Fig. 9, but a wider headland will be required (by the quantity  $a$ ). In this case, for a curve of  $90^\circ$  or  $180^\circ$ , where are the values: — *Total journey* =  $1.5S$ , or  $3S + DD_1$ ; *total work* =  $1P$  or  $2P$ .

by each evolution is, on the contrary, greater than that resulting from narrower, or at least equal, turns. Moreover, the repeated passage of the wheels over the length  $DD_1$  damages the soil so much that there is very poor grip when turning the last furrows on the edge of the field.

*Orthogonal Turn or at  $270^\circ$*  (Fig. 10). — From  $B$  to  $C$ , complete turn to the right; from  $C$  to  $C_1$ , without a manœuvre, a quarter circle with the smallest turning radius  $OC$ ; from  $C_1$  to  $D$ , complete turn to the left. *Total journey* =  $2.5 S$ ; *total work* =  $2 P$ .

This manœuvre, useful for hauling mowers or harvesters, is recommended by several authors for ploughing also, for preparing the finishing curves at the headland (Fig. 4), turning the head furrows  $m, m, m...$  and the side furrows  $n, n, n...$  which permits of shortening the furrows by diminishing the work on the curve (Fig. 11). But it is advisable: — 1) either to eliminate these difficult orthogonal turns, by arranging that the first furrow should end in  $M$  (Fig. 12) from the beginning of normal ploughing and that the subsequent furrows should be gradually prolonged until they describe the curve  $M N$  suitable for turning the machine; 2) or to replace the orthogonal turns by figure-of-8 turns (described later) limited to the chief headlands when they must be reduced to the same breadth as the side headlands.

*Double or figure-of-8 turns* (Figs. 13, 14, 15, 16). — These are necessary (if the machine has no reverse, or if, having one, the coupling to the ploughs is not rigid) when the machine has to turn in a space narrower than  $BD$  of Fig. 6 (*i. e.*, usually less than 6 metres), as when the first furrow is being opened or the ploughing finished.

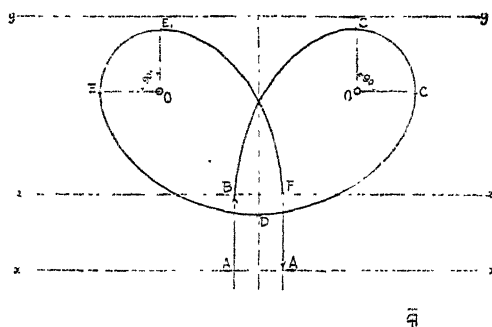


Fig. 14 — Another example of a double turn within the headland, symmetrical to the axis of the furrows.

Figures 13 and 14 give examples of two double turns in the limits of breadth of the ordinary headland. That of Fig. 13 is longer and more difficult, as it requires: *Total journey* = about  $6.15 S$  and *total work* =  $4.5 P$ , while the turn in Fig. 14 requires: *Total journey* =  $5 S$  and *total work* =  $4 P$  and it is easier to carry out, being symmetrical to the axis of the furrows.

Figures 15 and 16 show two double turns inside the field, with no head-

land, as in ploughing without ridges or by the Fellenberg method. The turn of Fig. 15 is symmetrical to the axis of the furrows but is much longer than that of Fig. 16. The respective values are : — *Total journey* = 6.75 S and 3.8 S; total work 3 P.

The various evolutions illustrated by these figures illustrate special problems, for, in practice, freedom in turning allows the driver to enlarge or diminish the curve of the turns at will by decreasing or increasing the turning speed, but the relation of the journey and especially of the total work remains practically the same.

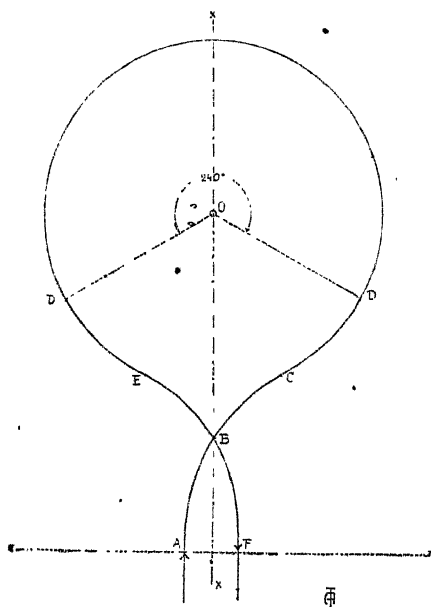


Fig. 15 — Double turn inside the field, symmetrical to the axis of the furrows.

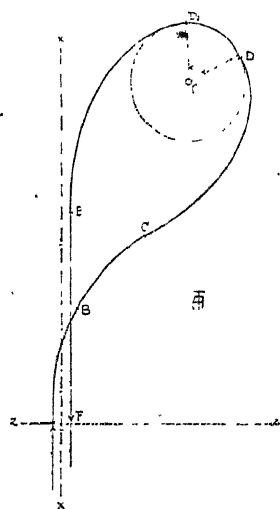


Fig. 16 — Double turn inside the field, not symmetrical to the axis of the furrows and shorter than that of Fig. 15.

This is why, when buying a ploughing machine, it is very important to study and observe its behaviour in the field, by means of repeated turning trials on the field with the ploughs lifted, not only with the object of exercising the driver and making the turns more exact and sure, but also on account of the need for arranging the division of the field and even the choice of the methods of ploughing so as to suit the type of machine.

SECOND PART  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

DEVELOPMENT  
OF  
AGRICULTURE  
IN VARIOUS  
COUNTRIES

832 - The Agricultural Development of the East Coast of Sumatra. — BLINK, H., in the *Tydschrift voor Economische Geographie*, Nos. 3 and 4, pp. 100 + Figs. + Tables. The Hague, April, 1918.

The paper under review contains an historical, geographical and economical survey of the Island of Sumatra, with a general historical introduction. It includes the hydrography, geology, climatology, ethnography, general economic development, agriculture, industry, and commerce of the district.

In the chapter on AGRICULTURE a special study is made of the cultivation of tobacco, one of the most important crops of the island. It was first started on a large scale and organised by Europeans towards the middle of the 19th. century. Several companies were formed, most of which cultivated rubber as well as tobacco. The development of tobacco was extraordinarily rapid in certain years; the total crop which, in 1864, was 460 cwt., rose in 1913 to 3955 113 cwt. The first plantations were on cleared forest land. The produce was of a dark shade much in demand. To avoid continual clearing a rotation system was adopted including a tobacco crop every 6 or 8 years, followed immediately by a rice crop, after which the ground is left fallow for some time; as green manure *Crotalaria striata* is grown. The subsequent adoption of modern cultural methods produced a tobacco of lighter colour but fortunately without modifying appreciably the flavour or aroma. The tobacco is sown early in the year under frames ("pajongs") and when the plants have developed sufficiently they are transplanted. After a few months the plant is about 8 feet high and has 40 to 50 leaves, the longest of which are 19 ½ to 23 ½ inches long. The drying-rooms can hold an average of 1 million leaves, which are afterwards piled up so as to attain the necessary suppleness. In sorting preference is given to Chinese workers who are more apt than the natives to distinguish differences in the shade and consistency of the leaves. The sorted packets are compressed hydraulically into bales of 176 lb. The cultivation of tobacco has changed the appearance of the country, formerly covered with virgin forests, which have given place to plantations and dwelling. The swamps have been

drained, roads and bridges built, sanitary conditions improved, and an agricultural experiment station ("Deli-Proefstation te Medan") established at Medan.

The more recent crops as yet cultivated to a smaller extent than tobacco are then described :—

1) RUBBER. — The cultivation of rubber on a large scale was started towards 1902, and has since developed rapidly. The plantations, which did not exceed 435 acres, in 1916 covered an area of 259 999 acres with a production of 15 265 metric tons. A yield of 45 000 metric tons is anticipated for 1921, and the district will then be able to supply an important percentage of the world production. Exportation was formerly chiefly to London, Antwerp, Amsterdam and Hamburg, but since the war it is more largely to America. In 1916 the exportation of *Hevea* rubber was :— United States, 112 936 cwt; United Kingdom, 95 404 cwt.; Singapore, 20 878 cwt.; Penang, 11 219 cwt.; Java, 117 105 cwt; Netherlands, 435 cwt. The soil, usually white clay in the plains and darker on the hills, and the even, rainy climate without long periods of drought, favour the cultivation of *Hevea*, which supplies most of the rubber.

2) COFFEE. — In 1903 the average production was 42 600 *picol* (41 761 cwt.). Most varieties of coffee-plants only begin to yield 3 years after planting; they are grown between the trees in the rubber plantations, which usually only begin to yield after 4 or 5 years. The varieties mostly grown are *Robusta* and *Liberian*, as well as *Javan*, and *Quillou* from the French Congo. In 1916 the exports amounted to 73 600 cwt.

3) TEA. — The district is fairly well adapted to tea-growing, which requires a moist atmosphere and continuous and regular rains. The exports, mostly to London, were 30 096 cwt. in 1916.

4) COCONUT. — This is grown particularly in the valleys and low districts along the coast as the sea assures the necessary humidity and constant temperature. In 1916, 90 348 cwt. of copra were exported.

5) OTHER CROPS. — In 1916 *oil-palms* were grown over 9 000 acres and this acreage will certainly be extended in view of the increasing demand for palm oil for making candles, vegetable butter, soap and glycerine. As there is a crop only every 3rd or 4th year coffee is also grown here between the trees. The *sago-tree* is partly cultivated, partly wild; the exportation of sago amounted to 2 621 cwt. The *gambier* gives a resinous gum used for tanning and dying, of which 44 361 cwt. were exported in 1916, chiefly to Great Britain. *Betel* is obtained from the fruit of *Areca Catechu* L. The cultivation of *pepper*, once very flourishing, has greatly decreased. New crops have recently been attempted, particularly *agave*, *sesame* and *sugar-cane*. *Soya* has been introduced in the tobacco rotations.

6) FOREST TREES. — Before the arrival of Europeans most of the district was covered with forests, and wood was one of the most important branches of native trade. The exportation of forest produce has much decreased but is still fairly important. The extension of modern agricultural enterprise has spared only those forests on ground inaccessible for cultivation. For this reason the forests are found now especially on the mountains or hills. The principal trees are :—

*Azelia palembanica*, which gives an excellent wood for building; *Sloetia Sideroxylon* which yields a reddish wood which turns brown when exposed to the air; it is the most solid in the district. There is no very marked limit between the species of the plains and those of the hills, but there is transition, the larger specimens being found in the mountains. In the plains it is only in the relatively wild districts, interspersed with marshes, that forests are still found. Most of the species belong to the Dipterocarpaceae family; two Oleaceae — *Scorodocarpus borneensis* and *Ochanostachys amentacea* — give a good quality wood; one Loganiaceae — *Fagraea fragrans* — gives an almost white wood. *Cerriops Candolleana*, *Rhizophora conjugata*, *Brugniera gmnorhiza*, etc., should also be mentioned.

The felling of wood is particularly along the water-courses and tends to increase more and more. The local consumption of building wood increases continually near the agricultural estates, and the authorities have taken steps to form reserve forests in the mountains.

#### RURAL HYGIENE

833 - The Influence of Specific Carbohydrates and Grains, Other than Oats, on the Development of Scurvy. — PRIZ, W. (University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 3, pp. 471-482 + 12 Charts, Bibliography. Baltimore, 1918.

I) *Effects of Carbohydrates and specially of Lactose*. — In a previous paper (1) MCCOLLUM and PRIZ had put forth the theory that scurvy in the guinea-pig results from the absorption of toxic substances arising from putrefaction in the cœcum due to undue retention of fœces.

HULL and RERTGER showed with white rats and also with men fed on a high protein diet that the bacterial flora of the intestine could be changed from a putrefactive flora to an acidophilus flora by the ingestion of lactose in the diet. Other carbohydrates as sucrose, dextrose, maltose, etc., produced a similar, but less pronounced, effect. It results from this that any substance that will thus change the intestinal flora should prevent the onset of the symptoms of scurvy. In order to test this supposition guinea-pigs were fed oat meal and whole milk, plus a carbohydrate. The results obtained show that a subject already affected begins to recover, while healthy subjects are completely protected by adding lactose to their diet. Excepting dextrose, which has only a slight action, the other carbohydrates had also a partially preventive action which, although less than that of lactose, maintains the animals in much better condition than when they are fed on oat flour and milk alone.

II) *Influence of Grains, other than Oats*. — The author fed guinea-pigs on ground grains of barley, wheat and maize, together with as much milk as they would consume (which favoured constipation). The barley grains caused scurvy after 4 weeks, those of maize after 5 to 6 weeks and those of wheat after only 3 weeks.

It may be concluded that grains of barley, wheat, and maize fed with large quantities of milk, so as to produce constipation caused scurvy,

(1) See R., 1914, No. 547. (Ed.)

but did not favour it as much as oats. In fact, for these grains, 10 per cent of lactose added to them was just as effective in preventing scurvy as was 20 per cent when fed with oats.

834 - **An Experimental Chronic Beriberic Syndrome**(1). — WEILL, E. and MOURIQUAND, G., in the *Comptes Rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 8, pp. 432-435. Paris, April 27, 1918.

As the result of experiments made on pigeons, the authors have concluded that by the side of an acute beriberic syndrome (EYKMAN'S syndrome appearing about the 20th or 25th day) there exists a chronic beriberic syndrome that appears much later and which can be caused especially by a partially deficient diet (in the present experiments by a mixture of  $\frac{1}{3}$  of wholly raw seeds with  $\frac{2}{3}$  of sterilised seeds). This syndrome is characterised by incipient paralysis of the wings, which may be followed by paralysis of the claws; it is completely resistant to treatment with raw epidermis, considered to be a specific.

In the experimental, acute, beriberic syndrome, recovery is obtained in a few hours by administering raw epidermis or by injecting vitamines, as if the paralysis was solely due to a chemical change in the nerve centres. The chronic cases that are almost entirely resistant to treatment with epidermis appear to be caused by profound nervous lesions (a natural consequence of the chemical change). The clinically "functional" paralysis of the former cases should be clinically "lesional" in the latter.

In a note on the previous communication, M. L. LAPICQUE records similar results that he has obtained with mice fed exclusively on white wheat flour. After a few days the young mice showed serious disorders, which were at once cured with whole wheat. When fed with white flour the adult mice only showed the characteristic neuritis after several weeks, and when once the disorder was manifest, recovery could not be obtained by adding either casein or whole wheat to their diet.

835 - **The Value of the Yeast Vitamine Fraction as a Supplement to a Rice Diet.** — EMMETT, A. D. and MCKIM, L. H., in *The Journal of Biological Chemistry*, Vol. XXXII, No. 3, pp. 409-419 + 4 Diagrams + Bibliography of 9 Publications. Baltimore, Md., December, 1917.

In the present paper the authors report the first of a series of investigations that deals more particularly with the efficiency of the vitamines from autolysed brewer's yeast (2), in respect to their value as an *adjuvant* to a diet that has been shown to be deficient in some particular vitamine.

From these studies, which have extended over a much longer period of time than any of those previously reported on this subject, it appears: —

1) That ordinary fuller's earth, ground to a definite fineness, absorbs the yeast vitamine fraction from the autolysed yeast filtrate as readily as the special form of fuller's earth, called Lloyd's reagent. Further, the

(1) See *R.*, 1916, No. 415; *R.*, 1917, Nos. 260 and 566. (Ed.). — (2) See also *R.*, March 1918, n. 341. (Ed.) See also: *B.* 1912, No. 1130; 1914, No. 871; 1915, No. 1239; 1916, No. 612 and 1254. (Ed.)

"Kieselguhrs" (infusorial earth, "celite B," and "filtercel") do not absorb the yeast vitamine.

2) That these two forms of activated fuller's earth are equally potent and very efficient as therapeutic agents in the treatment for typical attacks of avian polyneuritis.

3) That silicates in the form of ordinary fuller's earth, Lloyd's reagent or infusorial earth, when added to a polished rice diet, do not inhibit or accelerate the onset of avian polyneuritis; and that lactose, used in making the vitamine tablets, is also inert in this respect.

4) That the activated fuller's earth when given as a rational supplement to a polished or a brown rice diet, acts as a partial stimulant to increase the weight of the treated polyneuritic pigeons; it does not, however, in the case of the polished rice, accelerate the increase in weight to anything like that which is produced under similar conditions with brown rice alone, corn, barley, or hulled oats; and comparatively speaking, this activated yeast vitamine is not a complete supplement to a polished rice diet.

5) That there are apparently two so-called vitamins associated with rice polishing, one which cures polyneuritis and one which produces weight, and of these two the SEIDELL yeast vitamine preparation contains chiefly the curative fraction, along with a small per cent of the other.

Finally, it is evident, that while this activated yeast vitamine product is a valuable adjuvant to the diet in the case of convalescents from avian polyneuritis, yet for the best results, the diet should, in addition, be made up in part at least of vitamine-containing foods, not for the purpose of preventing the recurrence of typical attacks of this dietary deficiency disease (for the preparation is able to do this) but with the object of bringing about normal gains in weight and complete recovery.

836 - Studies on the Digestibility of Some Nut Oils. — HOLMES, A. D. (Office of Home Economics), in the *U. S. Department of Agriculture, Bulletin No. 630*, pp. 19 + 7 Tables + Bibliography of 20 Publications. Washington, April 16, 1918.

The author undertook a series of studies on the oils of several nuts in order to determine their digestibility as compared with those of animal or vegetable fats commonly used as foods.

All the oils were administered in the same way and with the same rations, so that the results as to their digestibility were directly comparable. A blancmange, or cornstarch pudding, was used as the basis of the ration and contained the oil for experiment; wheat biscuit, oranges and sugar were also given. All the food was cold with the exception of tea or coffee (without milk) which the subjects were allowed to take with their meals if they liked. The subjects were adult men between 20 and 40 years of age, mostly engaged in mental work, but taking sufficient exercise to make their energy requirement greater than that of most people with sedentary professions.

The experiment lasted 3 days and included 9 meals. The faeces were carefully analysed. The oils tested, the average daily amount consumed, and their coefficient of digestibility were:



1) Almond oil from *Prunus Amygdalus*, ration 70 gm., coefficient of digestibility 97.1 %.

2) Black-walnut oil, *Juglans nigra*, ration 56 gm., coefficient of digestibility 97.5 %.

3) Brazil-nut oil, *Bertholletia excelsa*, ration 81 gm., coefficient of digestibility 96.3 %.

4) Butternut oil, *Juglans cinerea*, ration 43 gm., coefficient of digestibility 95.4 %.

5) English-walnut oil, *Juglans regia*, ration 78 gm., coefficient of digestibility 97.6 %.

6) Hickory-nut oil, *Carya ovata*, ration 95 gm., coefficient of digestibility 99.3 %.

7) Pecan oil, *Carya Pecan*, ration 104 gm., coefficient of digestibility 96.8 %.

The average daily amounts given above are not maximum and may be exceeded.

These oils have about the same digestible qualities as the common vegetable oils (cottonseed, groundnut, olive oils, etc.). They are all liquid at ordinary temperatures. The data obtained with regard to the digestibility of the protein and carbohydrates consumed with these oils show them to have no abnormal influence on the digestibility of other foods eaten with them. The results shows that, as these oils are very well assimilated by the human body, they may be used freely for food purposes.

**837 - Experiments on the Digestibility of Fish.** — HOLMES, A. D. (Specialist in Charge of Digestion Experiments, Office of Home Economics), in *U. S. Department of Agriculture, Bulletin No. 649*, 14 pp. Washington, April 13, 1918.

In the study of the digestibility of the protein and fat supplied by some common varieties of fish, fish in the form of "fish loaf" was served as the major part of a simple mixed diet, which also included potatoes, crackers, fruit, sugar, and tea or coffee. Considering the experiments as a whole, the total diet supplied on an average 99 gm. of protein, 60 gm. of fat, and 160 gm. of carbohydrates daily, the fuel value being 1576 calories. The low amount of fat and of carbohydrates was due to the fact that butter and similar fats were omitted and the foods other than fish loaf which supplied both protein and carbohydrates, were limited in order that both the fat and the protein in the diet might be contributed in as large proportion as possible by the fish.

The principal results are summarised in the following table : —

Number of experiments	Kind of fish	Average amount of fish eaten per man per day	Digestibility of fish protein	Digestibility of fish fat
		grams	per cent	per cent
3	Mackerel ( <i>Scomber scombrus</i> ) . . . . .	448	93.1	95.2
3	Butterfish ( <i>Peronatus triacanthus</i> ) . . . . .	471	91.9	86.4
8	Grayfish ( <i>Squalus acanthias</i> ) . . . . .	440	92.8	94.3
4	Salmon ( <i>Oncorhynchus tshawytscha</i> . . . . .	355	93.2	93.7

As these figures show, the average coefficients of digestibility for fish proteins are in close agreement, therefore it would seem, from a dietetic standpoint, that the different fishes studied would supply protein in equally available form. The fats were well assimilated in the case of the mackerel, grayfish, and salmon, which, according to the usual custom, are to be regarded as "fat fishes". Considering the experiments as a whole, the very complete utilisation of the protein and fat supplied by the fishes studied offer additional experimental evidence that fish is a very valuable food and that its extensive use in the dietary is especially desirable.

## CROPS AND CULTIVATION.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

838 - Movement and Distribution of Moisture in the Soil (1). — HARRIS, F. S. and TURPIN, H. W. (Utah Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. X, No. 3, pp. 113-155, 31 Figs., Bibliography of 35 Publications. Washington, D. C., July 16, 1917.

During recent years considerable difference of opinion has arisen regarding the importance of the capillary movements of soil moisture and also regarding the laws governing the final distribution of moisture in the soil. In order to solve this problem the authors carried out a series of laboratory and field experiments under irrigation and dry-farming conditions. The experiments represent several thousand moisture determinations. The field studies include the effect of fallow, kind of crop, manure, irrigation water, surface mulches, cultural methods, and seasonal conditions on the movement and distribution of soil moisture. The laboratory studies include the effect of the initial percentage of moisture, gravity, soil type, source of supply, etc., on the movement and distribution of moisture in the soil.

RESULTS. — In field soils the moisture content of the fallow soils averaged greater than that of the cropped soils.

Unmanured irrigated land showed less difference in moisture between cropped and fallow than did the manured.

Irrigation influenced the top feet of the cropped plots proportionately more than the fallow, but water did not appear to penetrate the fallow plots below 7 feet as readily as it did the cropped ones. Under dry farming conditions the difference in moisture between cropped and fallow plots was not noticeable until after June 16. Cropped plots showed more fluctuation than fallow ones. Wheat, maize, potatoes, and peas drew most of their moisture from the first 4 feet in depth. The wheat land contained less moisture in the autumn than the other cropped soils, with maize following.

The increase in moisture due to applications of 5 to 7  $\frac{1}{2}$  inches of irrigation water was felt to depths of 10 feet in 24 hours, although most of the increase was in the first 4 feet.

(1) See also B. April 1914, No. 308; R. January 1916, No. 8; R. Dec. 1917, No. 1111; R., February 1918, No. 128. (Ed.)

The effect of mulches in preventing moisture loss under both irrigation and dry-farming was noticeable several feet below the surface of the ground, but the surface foot showed the greatest benefit from mulches. A straw mulch proved considerably better than a 2-inch soil mulch.

Mulches on irrigated plots appear to influence the moisture content of the soil to greater depths than do those under dry-land conditions. A dry-farm plot kept free from weeds in 1916 but not mulched lost very little more water than one mulched 2 inches deep. A 6-inch cultivation on spring-ploughed and a 2-inch cultivation on autumn-ploughed dry-farm land seemed to conserve the moisture best.

Subsoiling 15 inches deep had little influence on the moisture; spring discing was rather a distinct benefit.

An 8-year average shows that spring ploughing under dry-farming conditions at Nephi conserves moisture better than autumn ploughing. This difference in favour of spring ploughing is shown more below the first foot than in the first foot, and more in summer and autumn than in spring.

A precipitation as small as 0.1 inch under dry-farming conditions could not be detected in moisture determinations soon after, but, when as much as 0.5 inch fell within a short time, an increase in moisture was noticed to a depth of 6 feet.

When freely supplied with water, a soil with a high initial percentage of moisture will come to a moisture equilibrium sooner than a drier one, but if given time the drier soil will absorb a greater quantity through a long distance either upward or downward than will the wet one.

The rate of moisture penetration in the first 10 days was nearly twice as great with initial percentages above 15 as with 5 or below, and nearly twice as rapid after a 15-inch irrigation as after a 5-inch one. Under the most favourable conditions 7 feet was influenced in 10 days.

Moisture movement from soils of optimum moisture content into soils of differing initial percentages varied to an extent inversely as the initial content of the dry soil. At the end of six weeks, however, the amount of water actually in the soils still varied directly as the initial percentage.

The higher the percentage of moisture in the soil supplying the water to a dry-soil, the more rapidly and farther from the source of water did the moisture move.

Even when the source of water was an unsaturated soil, greater and faster movement took place when the water was moving downward than upward. When the quantity of soil yielding the water was so small as to make the total moisture content of both moist and dry soils very low if equally distributed, the effect of gravity was not great.

Moisture from a nearly saturated soil moved a greater distance into loam than into sand in 139 days and into sand farther than into clay. The clay, however, contained more moisture in the layer of soil next the water supply than the others and sand contained by far the least.

Sand, with 7.77 per cent of moisture, gave up its moisture to loam much more readily than did loam with 31.09 or clay with 24.62 per cent of moisture.

The rate of rise of moisture from soils of varying fineness when used either as water sources or water absorbers varied inversely with the fineness. Water rose to a height of over 30 inches in a loam soil from a moist sand in 94 days, while from a moist clay it rose little more than 6 inches in this length of time. In all soils the most rapid rise of the water was during the period soon after being placed in contact with the water.

Although the rise of the moisture was more rapid in the sand and loam than in the clay, the rise continued steady longer in the clay than in the others.

**839—Studies in Soil Reaction as Indicated by the Hydrogen Electrode (1).**—I. PLUMMER, J. K. (North Carolina Agricultural Experiment Station), Studies in Soil Reaction as indicated by the Hydrogen Electrode, in the *Journal of Agricultural Research*, Vol. XII, No. 1, pp. 19-31, + 8 Tables + Bibliography of 13 Publications. Washington, D. C., January 7, 1918. — II. HOAGLAND, D. R. and SHARP, L. T. (Agricultural Experiment Station of the the University of California), Relation of Carbon Dioxide to Soil Reaction as Measured by the Hydrogen Electrode, in the *Journal of Agricultural Research*, Vol. XII, No. 3, pp. 139-148 + Bibliography of 11 Publications. Washington, D. C., January 21, 1918.

The hydrogen electrode has been used by the author for indicating soil reaction on a number of untreated soils in suspension. The soils experimented with represent a wide range in texture of those common to the area of the southeastern portion of the United States, extending from and including the Appalachian Mountains to the Atlantic Ocean. The H-ion concentration varies from almost "true neutrality" to rather excessive "true acidity" in the soils.

With the Morgan apparatus for extracting film water from soils, it was shown that its reaction is the same as the free water, differing only in intensity.

The effects of certain fertilisers on the H-ion concentration of long-time-treated plots of three soils were measured, with the following results: — 1) ammonium sulphate materially increased the H-ion concentration of all plots which received applications of this material. The acidity thus developed often extends to the subsoil; 2) sodium nitrate slightly reduced the acidity of the plots to which it was applied; 3) potassium sulphate increases the "true acidity" when applied to soils, though not as greatly as ammonium sulphate; 4) acid phosphate does not appear to affect in either direction the H-ion concentration of field soils. 5) Lime materially increases the OH-ion concentration of field plots to which it has been added.

The acidity developed from ammonium sulphate was more intense in the film than in the free water of the three soils.

Monocalcium phosphate does not change in any way the soil-film water until excessive amounts are added.

(1) Though the hydrogen electrode has been used for some time in indicating changes in reaction, GILLESPIE was the first to use it on an extended scale as an indicator of reaction in soils (See R. 1916, No. 733). Later SHARP & HOAGLAND measured the hydrogen-ion concentration of numerous soils in suspension and they also applied the method to the study of other phenomena of the soil.

II. — In a previous article (SHARP, I. T. and HOAGLAND, D. R., Acidity and Absorption in Soils as Measured by the Hydrogen Electrode, *Journal of Agricultural Research*, Vol. VII, No. 3, pp. 123-145) the authors have presented data concerning the question of soil reaction as determined by the hydrogen electrode. Since this work did not include direct measurements of the effect of carbon dioxide on the reaction of soils, it was thought desirable to carry out further experiments on this point.

The H-ion concentrations of soil suspensions were measured under various partial pressures of carbon dioxide, with the following results: —

The H ion concentration of suspensions of acid soils is not markedly affected by increasing the content of carbon dioxide up to 10 per cent. The H-ion concentration of slightly alkaline soils is slightly increased by such treatment. A notable increase in H-ion concentration is observed when soils containing alkali carbonates are similarly treated.

It has not been found that any treatment with carbon dioxide can produce an alkaline reaction in the suspension of an acid soil.

When the original conditions are restored, no permanent change in soil reaction could be attributed to the carbon dioxide.

Further experiments with the hydrogen electrode have confirmed the point of view that solutions in equilibrium with acid soils contain H-ion in excess of OH-ion.

840 — **Humus in Mulched Basins, Relation of Humus Content to Orange Production, and Effect of Mulches on Orange Production.** — JENSEN, C. A. (Bureau of Plant Industry, U. S. Dept. of Agric.), in *Journal of Agricultural Research*, Vol. XII, No. 8, pp. 505-518, 8 Tables, Bibliography of 10 Publications. Washington, D. C., February 25, 1918.

This report presents a study on: — a) the changes in humus content in soils in basins mulched with different organic substances; b) the effect of lime on humus content in soils in mulched basins; c) the relation of humus content in the soil to orange production.

By "humus" is meant the brown- to black-coloured organic extract obtained from soil leached with 1 per cent hydrochloric acid to remove the calcium completely and the soil residue boiled for two minutes in a 7.5 per cent sodium hydrate solution.

Humus determinations in mulched basins in citrus groves showed a fluctuation in the percentages of humus from time to time. The average percentage of humus increased more in basins on clay loam soil than in basins on lighter soils, with manure and alfalfa as mulching materials. Usually the percentage of humus in basins increased more when manure was used as mulch than when alfalfa was used as mulch. This seemed, however, to be due more to the humus added with the manure, than to the greater "humification" of the manure over the alfalfa. When manure alone was used as mulch in basins the increase in humus was greater than when lime was added with the manure. In most cases when lime was added to alfalfa in basins greater increase in the humus content occurred than when alfalfa alone was used. Blood, acid phosphate, bone meal, tankage, or sulphur did not show any appreciable influence on the changes of humus content in mulched basins. It was not evident that there was any appreciable accu-

mulation of humus in the lower depths of soil due to the leaching of humus from the surface foot of soil. There was no evident correlation between the amount of humus in the soil in mulched basins and the amount of fruit on the trees. There was no evident effect of lime on orange production in these experiments. Alfalfa and bean-straw mulch in basins on the heavier soil types produced from 30 to 100 per cent more oranges per tree than manure mulch. Manure mulch produced more oranges per tree than either barley hay, sweet clover, bur clover, or pine shavings. These differences were obtained in the summer following the application of the mulches in the preceding autumn. Alfalfa mulch and manure mulch in basins on the lighter types of soil produced no observable differences on fruit production of lemons in the course of one year. In all experiments so far conducted by the Office of Biophysical Investigations, Bureau of Plant Industry, in the Riverside area, the mulched-basin system on the heavier soil types has produced favourable growth response in a few months. It usually takes longer to produce appreciable response on the lighter soil types. It appears that the degradation products from freshly decomposing organic substances are more effective in orange production than the amount of "humus" formed. And the value of a given mulch does not necessarily depend upon its being a legume or non-legume.

**841 - Formation of Black Alkali (Sodium Carbonate) in Calcareous Soils.** — BREAZEALE, J. F. (Biophysical Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.), in *Journal of Agricultural Research*, Vol. X, No. 11, pp. 541-589, 26 Figs., 48 Tables + 1 Plate, Bibliography of 7 Publications. Washington, D. C., September 10, 1917.

With the exception of an adequate water supply, the presence and accumulation of alkali is probably the most important problem that confronts the man engaged in farming under irrigation in the arid and semi-arid regions of the West.

As ordinarily used, the term "alkali" indicates the salts of sodium, together with calcium and magnesium salts in lesser amounts. In this paper the term includes all the water-soluble salts of the soil, whether organic, or inorganic. This paper discusses only one specific phase of alkali formation and that is that which takes place when sodium salts are present in a calcareous soil. The conclusions arrived at are as follows: —

- 1) In the reaction between sodium nitrate (or sodium chloride or sodium sulphate) and calcium carbonate, resulting in the formation of sodium carbonate, the presence of relatively small amounts of calcium nitrate or calcium chloride in the reaction impedes and may prevent the formation of sodium carbonate.

- 2) The presence of a saturated solution of calcium sulphate in this reaction does not entirely stop the formation of sodium carbonate.

- 3) Sodium nitrate, sodium chloride and sodium sulphate in the presence of carbon dioxide react with calcium carbonate with the formation of sodium bicarbonate.

- 4) The presence of relatively small amounts of calcium nitrate or calcium chloride in this reaction impedes and finally prevents the formation of sodium bicarbonate.

5) The presence of calcium sulphate has no effect in preventing the formation of sodium bicarbonate when sodium sulphate or a mixture containing sodium sulphate reacts with calcium carbonate.

6) A field application of gypsum will probably have no effect in overcoming black alkali if the soil already contains soluble sulphates in appreciable amounts, or if the irrigation water contains these salts.

7) Sodium nitrate, sodium chloride, and sodium sulphate increase the solubility of calcium carbonate in the soil.

8) Sodium nitrate, sodium chloride, and sodium sulphate react with calcium carbonate in the soil with the formation of sodium carbonate ("black alkali").

9) Sodium carbonate, formed by the above reaction, decomposes the organic matter of the soil.

10) Calcium carbonate has a slightly destructive action upon the organic matter of the soil.

11) Sodium carbonate is much more destructive to organic matter than sodium bicarbonate.

12) The alkali crusts that accumulate upon the soil in some irrigated regions are due in part to the action of sodium salts upon calcium carbonate with the formation of sodium carbonate.

13) Barren, or "slick", spots are often due to the action of sodium nitrate, sodium chloride, or sodium sulphate upon calcium carbonate with the formation of sodium carbonate.

14) Sodium chloride and sodium sulphate have a protective action upon organic matter in the presence of sodium carbonate.

15) A calcareous hardpan often produces black alkali.

842 - **Influence of Carbonates of Magnesium and Calcium on Bacteria of Certain Wisconsin Soils.** — FULMER, H. L. (Wisconsin Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XII, No. 8, pp. 463-504, 19 Tables, 11 Figs., Bibliography of 64 Publications. Washington, February 25, 1918.

It is a well-established fact that the majority of the changes of soil constituents are brought about by microorganisms and are influenced by the number and kinds of bacteria. The beneficial effect of lime, calcium carbonate, and magnesium carbonate on the growth of higher plants is generally preceded by an increase in the number of bacteria. An increase in the number of soil microorganisms is usually reflected in a more rapid decomposition of organic matter and a greater liberation of the inorganic soil constituents, chiefly potassium and phosphorus.

Although many important data have been obtained in relation to the effect of liming on the bacteria in soil, there still remain problems which deserve careful investigation — for example, the amount and kind of lime and calcium and magnesium carbonates that can be applied most economically and yet give the best results. The investigations described were undertaken with the hope of throwing some light upon the problem of soil bacteria and their response to applications of magnesium carbonate, calcium carbonate and limestone. The effect of these substance on pure cul-

tures of bacteria and on the ordinary soil flora was observed in: — a) acid Colby silt loam soil; b) acid Plainfield sand; c) neutral Miami silt loam.

From a brief review of certain of the more important papers relating to the effect of lime ( $\text{CaO}$ ), calcium carbonate and magnesium carbonate on soil microorganisms it appears that the addition of calcium and magnesium, either in the form of oxide or carbonate, to soil, and especially to acid soil, brings about conditions favourable to the growth of certain groups of microorganisms. There are many factors which have been given little or no consideration — for instance, what relationship exists between the total number of bacteria in soil and the quantity of soil acid neutralized? With few exceptions, little attention has been directed toward the relative effect of calcium and magnesium carbonates on the soil flora. There exists a diversity of opinion with regard to the relation of bacteria to these two compounds. This lack of harmony may be due to the difference in the soil types which have been studied. Again, it seems that no one has tried to measure the effect of calcium and magnesium carbonates on pure cultures of bacteria in sterilized acid soil. To obtain information with regard to these points, a series of experiments was planned.

Each of the 3 experimental soils was passed through a 4 mm. sieve and mixed. The calcium carbonate requirement of the 2 acid soils was determined: — to correct the active acidity of 100 gm. of soil on the dry basis 1.05 gm. were required for the Colby silt loam and 0.21 gm. for the Plainfield sand. Three bases were used to neutralize the acidity in these soils: — 1) pure precipitated calcium carbonate; 2) pure precipitated magnesium carbonate; 3) commercial ground limestone with 53 per cent of calcium and 43 per cent of magnesium oxide. They were added in amounts sufficient to neutralize  $\frac{1}{4}$ ,  $\frac{1}{2}$  and the total active acidity. In certain experiments varying amounts of monocalcium phosphate were added to the soil, alone and in various mixtures with calcium carbonate. The mixtures of soil and bases were poured into earthenware jars and the moisture content raised to one-half saturation with distilled water. At definite intervals samples were drawn and plate counts made. At regular intervals the effect of these compounds on the total number of bacteria in the soil, on ammonification and on nitrification was studied. The results were as follows: —

The number of bacteria in acid Colby silt loam and acid Plainfield sand is increased by the application of calcium carbonate, magnesium carbonate, or limestone. Magnesium carbonate increases the number to a much greater extent than does either calcium carbonate or limestone. Monocalcium phosphate and dibasic magnesium phosphate slightly increase the total number of bacteria in neutral soil.

Nitrification is benefited by limestone, calcium carbonate, and magnesium carbonate treatment. Magnesium carbonate in soil to which no nitrogenous substance was added favours nitrate accumulation more than does either calcium carbonate or limestone. The phosphates increase the accumulation of nitrate nitrogen to a very small extent. When gelatin was applied to the soil, magnesium carbonate did not benefit nitrification any more than calcium carbonate or limestone.



Ammonification in Colby soil is benefited by all three forms of the carbonates, while in Plainfield sand a decrease in ammonia is shown. Monocalcium phosphate increases ammonification in both soils.

Pure cultures of *Bacillus tumescens* and *B. subtilis* ammonify blood meal better when sterile Colby soil is treated with any one of the three forms of carbonates. A culture of *B. azotobacter* in the two soils treated with the carbonates and mannite fails to show an increase in total nitrogen in the sand and only a slight gain in the Colby soil. Pure cultures of *B. radicicola* of both alfalfa and lupine strains, and *B. azotobacter* are greatly benefited when inoculated into sterile Colby soil previously treated with magnesium or calcium carbonate. Limestone barely increases the number of *B. azotobacter* in Colby soil. In neutral and acid soils treated with magnesium carbonate until they were strongly alkaline, *B. azotobacter* greatly increases in number in comparison with that of the untreated.

From the data considered as a whole, magnesium carbonate is superior to calcium carbonate or limestone in stimulating the reproduction of bacteria in Colby silt loam and Plainfield soils. In general, the smaller applications of either compound give better results than do the heavier applications. Magnesium carbonate appears to play an important part in the development of soil bacteria, much more so than does calcium carbonate. Magnesium phosphate, when applied to neutral soil, caused an increase in the number of bacteria. In the neutral soil magnesium phosphate proved superior to calcium phosphate in stimulating the bacteria; in acid soil neither compound appeared to benefit the soil flora.

843 - The Gases of Swamp Rice Soils. — Part III. A Hydrogen-Oxidising Bacterium from these Soils. — Part IV. The Source of the Gaseous Soil Nitrogen. — HARRISON, W. H. and SUBRAMANIA AYER, P. A., in *Memoirs of the Department of Agriculture in India*, Chemical Series, Vol. IV, No. 4, pp. 135-148, 1 Fig., 9 Tables; Vol. V, No. 1, pp. 1-31, Figs. and Diagrams. Calcutta, 1916.

In a preceding memoir (1) published by the authors dealing with the relationship between the gases of swamp rice soils and the organized film present on the surface of the soil, it was shown that the latter possessed the power of oxidising hydrogen. This oxidation was further demonstrated to be due to the activities of certain bacteria and crude cultures were obtained and their action studied. A pure culture of a specific bacterium has been obtained and it is with this organism that the third part deals. It contains a description of the hydrogen-oxidising organism, together with the effect of different concentrations of various nitrogen containing chemicals upon its power to oxidise hydrogen. No name is assigned to the organism, but it is said to be different from previously described hydrogen-oxidising bacteria.

Part IV deals with explanations for the variation in quantity and composition of gases evolved from cropped and uncropped soils during different stages of growth. The authors demonstrate that a very considerable proportion of the gaseous nitrogen normally found in swamp paddy

(1) See R., 1914, No. 119; 1915, No. 490. (Ed.).

soils is produced through the decomposition of organic matter. The nitrogen thus liberated is derived from two distinct sources: *a*) from the decomposable organic matter of the soil or of the green manure used, and *b*) from a certain proportion of the roots of the crop which die and subsequently decompose. The production of gaseous nitrogen from soil organic matter and green manure persists throughout the growing season, but is most prominent during the earlier period, whereas that derived from root decomposition is most prominent during the later stages of growth and persists after harvest time. The crop does not interfere with, or materially alter, the normal course of the fermentation of the soil organic matter and green manure. The difference in the rate of evolution of gases from cropped and uncropped soil is due to a matted root condition existing near the surface which in conjunction with the fine soil particles mechanically hinders the escape of gases on cropped soil. After appreciable quantities of gas accumulated and the roots began to decay, which occurred about the time rice was jointing, the accumulated gas began to escape in large quantities, whereas on uncropped soil the escape was very uniform throughout the growing period. The difference in composition was found to be due to the influence of the same factors. The methane and hydrogen retained near the organised surface film was oxidised thus giving to the gas finally escaping from cropped soil a much higher per cent of nitrogen and lower per cent of methane and hydrogen.

PERMANENT  
IMPROVEMENT,  
DRAINAGE  
AND  
IRRIGATION

844 - Artificial Glaciers for the Irrigation of Mountain Pastures, in India. —

I. DAINELLI, G., in the *Rivista del Club Alpino Italiano*, Vol. XXXVII, Nos 1, 2, 3, p. 30. Turin, January, February, March, 1918. — II. LUIGGI, L., in the *Annali d'Ingegneria e d'Architettura*, Year XXXIII, No. 9, pp. 139-140. Rome, May 1, 1918.

I. — Sig. G. DAINELLI, who explored the Caracoram hills in 1913-1914, records that the inhabitants of Cunis built an artificial glacier so that they could extend their fields and have sufficient water to irrigate them. The method was to choose a spot as high and elevated as possible and well protected from the sun; on a bed of straw they next placed a layer of gourds filled with water following with alternate layers of gourds and straw. If possible the straw is mixed with briars and wood charcoal. At the beginning of winter stones are laid on the upper layer, then a number of wide-necked earthenware pots full of water, which naturally freezes. After 2 or 3 months, when the great winter falls of snow have ended, the snow is covered, first with straw, then with earth, thus covering all the preceding material. The inhabitants repeat the same procedure the second and third years, extending the area each time. If, for example, 200 gourds are placed the first year, the second year 400 are placed, and so on. At the end of the fourth year the glacier is ready, and grows spontaneously each year, while each summer it furnishes the water required for the fields. The author has heard of artificial glaciers that have been working for over 40 years. The preservation of the initial glacier, i. e., that produced artificially by the 4 year's work, is easily explained as the materials that protect the successive masses of winter snow both above and below are bad conductors of heat. It is more difficult to explain how the glacier continues to work

afterwards without the addition of fresh insulating material. Very probably the fresh snow fallen on the system, while free from the warming action of the soil, melts in the summer on account of the air temperature, but freezes again on coming in contact with the underlying artificial layers at a very low temperature; the snow thus feeds the lower layers and compensates for the losses due to melting in summer. It is these losses that are used for irrigating the fields lying at a lower level. The fact recorded by the author was briefly described in 1867 by Mr. JOHNSON (1) in the description of his exploration journey across the Himalayan mountains.

II. — Prof. LUIGI LUIGGI, pointing out the construction of these artificial glaciers, is of the opinion that their construction as artificial lakes in the mountains would help to make the water supply more regular, and would lead to a more complete and better utilisation of the natural supplies of water of Italy.

845 — **Leakages from Irrigation Canals and Reservoirs in the U. S. A.** — DAVIS, A (Director and Chief Engineer, U. S. Reclamation Service), in the *Engineering News-Record*, Vol. LXXX, No 14, pp. 663-665. New-York, April 4, 1918.

In numerous cases in the United States the admission of water into irrigation canals and reservoirs has disclosed the existence of subterranean cavities not previously observed. The author quotes three examples of canal troubles (those of Flathead; Grand Valley Lands, Colorado; and Spanish Fork Canal, Utah) and six of difficulties with reservoirs (Jerome and Deer Flat reservoirs, Idaho; Lake McMillan and Hondo reservoir, New Mexico; Walnut Cañon reservoir, Arizona; and Tumalo reservoir, Oregon). For each of these he describes the difficulties and the remedies applied, discussing the successes or failures.

Some of the difficulties encountered, especially in canal building, are of such nature that no method of foreseeing them appears to be possible.

In the case of canals, however, these difficulties are usually easily remedied, either by puddling the cavities that appear, as at Flathead and Grand Valley, or by relocation, as at Caislsbad. Remedies in the case of reservoirs are not so easy. Puddling is useless if the subterranean conditions are such that the seepage of water can get away and thus let the seepage continue. No reservoir in earth is of much value if it continuously seeps at the rate that water can pass vertically through puddled earth. The problem then is to avoid regions where subterranean conditions are such that the water can escape. A few rules of caution may be of value:—

- 1) Avoid reservoirs adjacent to gypsum deposits and to limestone deposits which show evidence of caves.
- 2) Examine critically reservoirs in volcanic rock, as a few have failed in such locations. Coarse-grained sandstone seems to be an object of suspicion and should be carefully examined.
- 3) Natural depressions are treacherous and should be examined with

(1) JOHNSON, W. H., Report on his journey to Ilchi, the Capital of Khotan in Chinese Tartary, *Journal of the Royal Geographical Society*, 1867, Vol. 37, p. 23. (Author).

care, and if they are near deep cañons or underlain with coarse material where water might readily escape, no superficial tightness will avail to make them effective.

MANURES  
AND MANURING

846 - **New Deposits of Guano in the Philippines.** — In the *Philippine Agricultural Review*, Vol. X, No. 3, p. 301. Manila, 1917.

Owing to the inability to secure fertilizer material by even those planters who have learned the value of fertilizer for the growing of sugar cane, extensive search has been made for deposits of bat guano in the various parts of the Philippine Archipelago. In several instances, particularly in the southern provinces of the Island of Luzon, these searches have resulted in the location of extensive guano deposits. This material, however, has invariably contained a low percentage of nitrogen which condition was due no doubt to the extremely soluble substance containing that element having leached away during the rainy seasons. Analysis of this material showed the following average result: — Nitrogen 1, phosphoric anhydride 15, and potash 1 per cent.

847 - **Fertilising Value of Ammonium Nitrate.** — SCHOESING, TH. JR., in *Le Progrès Agricole et Viticole*, Year 35, No. 22, pp. 517-519. Montpellier, June, 1918.

Ammonium nitrate, hitherto little known by farmers because it has never been available in large quantities, will be able to be supplied liberally to them when no longer used for the purposes for which it is required under present circumstances. For this reason the author made tests of its fertilising value by pot experiments. Maize seeds of equal weight were sown in each pot, which contained about 17 lb. of soil with an initial moisture percentage of 12.0, and 15 gm. bipotassium phosphate as basic fertiliser. Except in the two control pots the nitrogenous fertiliser added to each contained 3.37 gm. of nitrogen; four pots contained ammonium sulphate and four ammonium nitrate. The plants were cut down to the ground at the beginning of earing and the following average weights per pot of the air-dried crop were obtained:—Control pots, 87.6 gm.; pots with ammonium sulphate, 106.8 gm.; pots with ammonium nitrate, 108.4 gm. Ammonium nitrate thus gave an increase in the dried crop almost equal to that of ammonium sulphate.

The soils in the pots was kept very moist. It was found that, although nitric nitrogen fertilisers give slightly heavier crops than ammoniacal nitrogen fertilisers, there is little difference in yield in very wet years.

It is usually admitted that the nitrogen of ammoniacal fertilisers must be nitrified before it can be used by plants. Several workers (MÜNTZ, MAZÉ, SCHLOESING JR.) have, however, shown that absorption occurs in the ammoniacal form as well as in the nitric one. The only difference is in the rate of absorption, a difference which might be explained by an influence of the absorbing properties of the soil on the ammonia. Till it is nitrified ammonia will also be less mobile. For this reason an excess of water, while favouring the equilibrium movements which cause the dissolution of new quantities retained in the soil in proportion as absorption progresses, exercises a very good influence in this case.

848 - **The Potassium Problem (1) and the Utilisation of Olive Oil Residue, in Italy.**—  
L'ABATE, G., *Il problema della potassa e l'utilizzazione delle "morchie"*, pp. 8. Bari,  
Laterza & Figli, 1918.

The potassium question is one of the most serious problems for all agricultural countries, especially Italy, which consumes much less than other states using it, though they may be less agricultural. Among the various types of fertilisers, some of which, the superphosphates, have developed greatly, potassium is not yet very largely used by Italian farmers. As sources of potassium in Italy there are the mother-lyes of the salt-springs; the leucites of Latium, the ashes of wood and other vegetable products (almond shells, exhausted olive cake). Taking the whole as a sole source of potassium salts for agriculture, there only remains at present, according to the author, distillery residue, and, as a less limited and hitherto untested source, the residue ("morchie") from the manufacture of olive oil.

Samples of olive oil residue from the province of Bari showed the following composition, in grams per litre:— water, 884.891; mineral, 30.65-35.48; organic matter, 79.85-80.60; fat, 10.50; nitrogen, 10. These results led to a comparison between the residue from olive oil with that from distilleries and molasses, with a view to using it, like these products, for extracting potassium salt, of the following composition:— water-soluble matter, 80.31 %; matter insoluble in water (carbon, silica, lime, magnesia and 8 % phosphoric acid combined with calcium, iron, and aluminium), 19.09 %; potassium carbonate, 55.15 %; sodium carbonate 2.57 %; potassium chloride, 21.89 %; traces of potassium sulphate; water, and other undetermined substances, 20.39 %. When refined this product gives on an average:— potassium carbonate, 68.88 %; sodium carbonate, 3.2 % and potassium chloride 27.27 %, thus resembling, in its potassium content, similar products extracted from molasses and used as fertilisers.

The olive oil residues of Apulia give more than 30 gm. of potassium salts per litre, equivalent to 3 kg. (6.6 lb.) per hectolitre (22 gals.), with 48 % of potassium as carbonate (50-60 %) and chloride (15-20 %). The yield of olive oil residue, although depending largely on the weather, represents almost three times the amount of oil produced, or 30 to 40 % of the weight of the olives. If the oil production of Italy is placed at 44 million gallons or 35 200 000 gallons as in the period 1909-1913, the amount of residue would be about 16 500 000 bushels. If all this were used, about 294 000 cwt. of crude potassium salt containing 141 320 cwt. of potassium would be obtained. If the nitrogen as well as the potassium is to be utilised it may be obtained as ammonium sulphate and potassium cyanide (e. g. by EFFRONT'S method).

In conclusion, the treatment of the 16 500 000 bushels of olive oil residue produced by Italy for the extraction of potash in factories in the districts with the largest production resolves itself essentially into a problem of transport, as for all poor and bulky matter.

(1) See R. April, 1918, No. 394. (Ed.)

849 - **Plant Succession in the South African Thorn Veld.** — BEWS, J. W., in *The South African Journal of Science*, Vol. XIV, No. 4, pp. 153-172 + 10 Figs. Cape Town, November, 1917.

The tree veld is perhaps the most extensive type of vegetation in the Continent of Africa. The species composing it in the various districts depend chiefly on climatic differences, but also on the soil. Practically all the dry valleys in the east of S. Africa are covered with tree veld in which species of acacia predominate. The Protea Veld is more mountainous and extends throughout Rhodesia. There are also other types of veld in this region, such as the Baobab (*Adansonia digitata*) Veld. The Transvaal Bush Veld is a combretaceous-leguminous type with *Terminalia*, *Combretum*, *Burkea*, etc. The mopane (*Copaijera Mopane*) is predominant in a large part of the Tree Veld of Angola and South Central Africa, whereas the Baobab Veld extends up to the Congo. Nearly all South Central Africa is Tree Veld, broken only by forests on the mountain slopes in the east. In the tropics, the great Congo forest and the dense forests which extend throughout the Cameroons and West Africa to Liberia cover a very extensive area, but north of this, and south of the Sahara there is Tree Veld very similar to that of S. Africa. In many parts of the tropics and sub-tropics various palms, such as *Hyphaene ventricosa*, *H. thebaica* or dum palm, *Borassus flabellifer*, etc., predominate. In view of the extent and importance of this type of vegetation in Africa, the study of the natural succession of plants in the veld is of the utmost value.

The species of trees, bushes and lianes which cover the Thorn Veld establish themselves in ravines and on the banks of water courses where the first seeds are carried by birds and other animals. These areas serve as bases for re-stocking the intermediate spaces. The author illustrates this vegetation by that observed at Bisley, where the most common trees, in order of their abundance, are: —

*Acacia arabica* var. *Kraussiana*, *Celastrus buxifolius*, *Hippobromus alata*, *Ehretia hottentotica*, *Jasminum multipartitum*, J. sp. (Gerardi?), *Elaeodendron aethiopicum*, *Zizyphus mucronata*, *Grewia caffra*, *Acacia caffra*, *A. horrida*, *Randia rudis*, *Xanthoxylon capense*, *Combretum Kraussii*, *C. salicifolia*, *Nuxia oppositifolia*, *Royena pallens*, *Pavetta lanceolata*, *P.* sp., (obovata?), *Cussonia spicata*, *Helinus ovata*, *Gymnosporia (Celastrus)* sp., *Brachylaena discolor*, *Dovyalis (Aberia) tristis*, *Azima tetracantha*, *Euclea undulata*, *E. lanceolata*, *Calpurnia* sp., *Rhus* spp. Climbing on these plants are various lianes: — *Dalbergia obovata*, *Vitis cuneifolia*, *V. cirrhosa*, *Clematis brachiata*, *Asparagus* sp., *Dalechampia capensis*, etc. The undergrowth is rich in herbaceous forms: — *Sansevieria thyrsiflora*, *Lippia asperifolia*, *Barleria obtusa*, *Scilla* sp., *Rubus rigidus*, *Vernonia corymbosa*, *Melasma* sp., *Kalanchoe rotundifolia*, *Cyathula* sp. and, near the riverbed, *Selaria imberbis*, *Pennisetum unisetum*, *Cyperus* spp., etc.

Acacias, especially *Acacia horrida* and *A. arabica* var. *Kraussiana* are the chief pioneer species. The author shows that, by their structure, these plants are adapted to unshaded localities where there is no protection against grass fires. These trees prepare the way for other species which follow and establish themselves under their shade, where they find

the soil well-prepared by the activity of earth-worms, termites and ants. There are various stages of vegetation and subsequent species may kill the pioneer. As a rule, however, the thorn-trees predominate in the Thorn Scrub, which at present forms the final stage over most of the areas.

The author gives a list of over 230 species of trees, bushes and lianes of the Thorn Veld, showing their frequency and the undergrowth. He distinguishes three important sub-formations: the Thorn Veld near the coast, that of rocky land, and that of the stream banks; the last two may be considered as distinct formations.

The question of seed distribution is discussed. Wind distribution is of relatively small importance. The chief agents of dispersal are birds, but for species with capsular fruit and small seeds, ants, which abound in the Thorn Veld, are also important.

850 - **The Glandular Pubescence of Several Species of *Medicago*: Observations made in California, U. S. A.** — MCKEE, R. (Office of Forage-Crop Investigations, Bureau of Plant Industry, U. S. Dept. of Agric.), in the *Journal of the American Society of Agronomy*, Vol. X, No. 4, pp. 139-162. Washington, March 20, 1918.

Many varieties of *Medicago* have been classified as sub-species on the basis of the presence or absence of the glandular pubescence, but the author's data show that, in certain varieties, this pubescence varies markedly with the environmental conditions. It can, therefore, not be adopted as a constant character in the determination of sub-species.

Field observations made during many years on several plants of *M. orbicularis* and its sub-species showed that, at the beginning of the season, none had pods with glandular pubescence, whereas later, after several hot, dry days, all the plants and all the pods, young and old, were strongly pubescent.

Some forms of *M. lupulina* are smooth and others hairy all their lifetime; most of them show the same variation, due to environment, as the preceding species (hot and dry weather, dry soil).

*M. falcata*, introduced into the United States, has a marked pubescence in one of its forms only — *M. falcata viscosa*; *M. sativa* is glabrous. Nevertheless, some plants of both these species show glandular pubescence. For this reason the author regards them as hybrids, although they show little variation in their other characters.

*M. hispida*, *M. Echinus*, *M. obscura helix*, *M. intertexta*, *M. tuberculata aculeata*, have a microscopical glandular pubescence on the pods at the beginning of the season, but lose it towards the end of the season.

851 - **Behaviour of Sweet Potatoes in the Ground.** — HASSELBRING, H. (Bureau of Plant Industry, U. S. Dept. of Agric.), in the *Journal of Agricultural Research*, Vol. XII, No. 1, pp. 9-17 + 1 Diagram. Washington, D. C., January 7, 1918.

In the course of previous investigations on the behaviour of sweet potatoes in storage, it was observed that the percentage of starch was always highest and the percentage of sugar lowest in freshly dug potatoes. The constancy of the condition seemed to justify the conclusion that in the growing sweet potato the reserve materials exist essentially in the form

of starch, and that the appearance of sugar in considerable quantities is a phenomenon occurring only in storage or after the destruction of the leaves.

In order to determine whether these quantitative relations between the starch content and the sugar content of the sweet potato remain constant throughout the latter part of the growing season, and to what extent they are changed by the death of the vines, the carbohydrate metabolism in Big Stem sweet potatoes was followed from the time the roots were large enough to furnish the requisite samples (end of August to beginning of September) until they were seriously damaged by frost. From the numerous analytical data given in three tables the following deductions are drawn for September 18 and 25, October 2, 9, 17, 23, and 30, November 6, 13, 20, and 27, respectively:—moisture (per cent):—73.92, 73.24, 73.87, 75.47, 76.30, 77.43, 77.78, 75.99, 78.14, 77.78, 78.93; starch (this percentage as well as the following ones are on a dry matter basis):—71.39, 72.39, 70.90, 69.28, 69.44, 68.51, 64.65, 63.58, 55.27, 50.73, 46.20; saccharose:—7.93, 7.52, 8.81, 8.58, 8.31, 8.86, 11.24, 13.75, 18.40, 23.11, 26.06; reducing sugar as glucose:—1.44, 1.22, 1.72, 2.23, 2.81, 2.80, 3.16, 2.69, 3.29, 3.20, 3.85; total carbohydrates:—80.76, 81.13, 81.43, 80.09, 80.57, 80.18, 79.05, 80.02, 79.96, 77.03, 76.11.

Thus the *moisture content* of the roots was almost uniform from September 18 to October 2, after which it gradually increased till the end of the season. The percentage of *starch* in the dry matter of the roots decreased slightly from September 18 to October 23, and then with increasing rapidity till the end of the season. The rapid disappearance of the starch follows, with a little delay, on the death of the leaves. The *saccharose* content remains practically constant between 7.52 to 8.86 till the rapid decrease of the starch, when it begins to increase correspondingly till it finally represents 26.06 % of the dry matter of the roots. As a rule the changes in cane sugar begin somewhat later than those of the starch. The *reducing sugar* first remains constant, then rises gradually, till the final percentage is slightly more than double the initial one. The increase in reducing sugar somewhat precedes that in cane sugar; this increase is less in sweet potatoes left in the ground than in those in store. The *total carbohydrates* undergo little change till towards the end of autumn, when the roots begin to show injury from frost, which causes evident loss of carbohydrates.

**CONCLUSIONS.**—The changes occurring in the roots of sweet potatoes left in the ground during the end of the growing period proceed regularly. When, on the death of the leaves, transpiration and the flow of material into the epigeal part ceases, the accumulation of water in the roots and the transformation of starch into reducing sugar and from that into saccharose begin. In stored and cured sweet potatoes there is considerable loss of carbohydrates due to respiration, whereas if the roots are left in the ground such loss is insignificant till the roots have been injured by frost. The accumulation of water in roots left in the ground is detrimental to their keeping qualities. It is precisely to reduce this moisture content



that the sweet potatoes are cured, thus giving a product which is generally acknowledged to keep better. It is of the utmost importance that sweet potatoes be not left in the ground after the leaves have been killed by frost.

852 - Comparison of the Hourly Evaporation Rate of Atmometers and Free Water Surfaces with the Transpiration Rate of *Medicago sativa* (1).—BRIGGS, LYMAN J. (Biophysicist in Charge of Biological Investigations) and SHANTZ, H. L. (Physiologist, Alkali and Drought Resistant Plant Investigations, Bureau of Plant Industry, U.S. Dept. of Agric.), in *Journal of Agricultural Research*, Vol. IX, No. 9 pp. 277-292, 4 Fig. + 3 Plates, Bibliography of 11 Publications. Washington, D. C., May 28, 1917.

The rate of evaporation from a free water surface or from a moist porous surface is usually considered the single-valued expression of the intensity of the weather factors influencing transpiration. Such a relationship is, however, subject to the uncertainty arising from the marked differences in the energy-absorbing and energy-dissipating properties of the transpiring and evaporating surfaces. It is evident that the transpiring and evaporating surfaces must be in agreement in this respect if the departure of transpiration from evaporation during the day is to be taken as evidence of a change in the transpiration coefficient, resulting from stomatal control or other reversible changes within the plant body.

Fluctuations in transpiration from day to day appear to be reflected with approximately the same degree of fidelity by a number of widely different forms of evaporating surfaces, provided precautions are taken to maintain the uniformity of these surfaces throughout the period of observation. When the hourly transpiration rate is under consideration, however, the individuality of the evaporating surface to which the transpiration is referred cannot be ignored. It is this phase of the question that forms the subject of the present paper, which deals with a comparison of the hourly transpiration rate of alfalfa with the hourly evaporation rates from various types of porous cup atmometers, a filter-paper evaporimeter, a blackened, shallow tank, and a deep tank.

The comparison between the transpiration rate and the evaporation rate was made by superimposing the hourly transpiration graph on each of the hourly evaporation graphs, choosing the scale of ordinates of the transpiration graph so that the total area under the transpiration graph was equal to the total area under the evaporation graph. The average hourly departure of each of the evaporation graphs from the superimposed transpiration graph expressed in percentage of the mean transpiration for the day was then determined. For the shallow tank the mean hourly departure for the 24 hour period was 17 per cent; for the filter-paper evaporimeter 31 per cent; for the brown cylinder, white sphere, and Bellani plate about 40 per cent; for the white cylinder about 50 per cent; and for the deep tank about 90 per cent of the mean hourly transpiration. The corresponding departures for the daylight hours from 6 a. m. to 6 p. m. were as follows: — For the shallow tank, 12 per cent.; filter-paper evaporimeter, 22 per cent.; brown cylinder,

(1) See also R. February 1917, No. 134. (Ed.).

white sphere, and Bellani plate atmometers, about 30 per cent ; white cylinder atmometer, 38 per cent ; and the deep tank, 93 per cent. Since the hourly evaporation graphs of the various evaporation systems employed differ widely in form, it does not seem justifiable to attribute the discrepancy between the observed hourly transpiration and that calculated from the evaporation rate of any particular system to a change in the transpiration coefficient of the plant during the day, unless it can be shown that under less extreme conditions the transpiration rate is in accord with the evaporation rate. The plant may not be responding freely to its environment, but a departure in its relative transpiration rate from the evaporation rate of an arbitrarily chosen physical system does not necessarily establish this fact. A close correspondence does not appear to exist between the hourly transpiration rate of normal alfalfa plants and the hourly evaporation rate of any of the systems employed in this investigation. The best agreement in this instance was obtained with the shallow, blackened evaporation tank.

The departure of the hourly evaporation rate of the porous-cup atmometer from the hourly transpiration rate of alfalfa is due largely : — 1) to the marked increase in the evaporation over transpiration during the night hours ; 2) to the marked response of the atmometers to changes in wind velocity, which were not accompanied by corresponding changes in the transpiration rate ; and 3) to the lack of a proportionate response on the part of the atmometers to changes in solar radiation.

It should be emphasised in this connection that the failure of an evaporating surface to show a high correlation with the hourly transpiration rate does not necessarily imply a correspondingly low correction on the daily basis. This is strikingly illustrated by the hourly evaporation rate from the deep tank, which, in these experiments, shows practically no correlation with the hourly transpiration rate, but which on a daily basis was found in 1914 to be correlated with the daily transpiration rate to the extent of  $0.63 \pm 0.01$ .

853 - **The Influence of Certain Organic Substances on Plant Growth.** — CIAMICIAN, B. and RAVENNA, C., in the *Atti della Reale Accademia dei Lincei*, Series 5, *Rendiconti*, Vol. XXVI, First Half-Year, Part 1, pp. 3-7. Rome, January, 1917 ; Vol. XXVII, Part 7, pp. 38-42. January, 1918.

The authors describe experiments on the influence of certain organic substances on plant growth, especially with kidney-beans germinated and grown on absorbent cotton.

The substances tested were — mandelic nitrile; benzylic and salicylic alcohols as potassium salts ; vanillin ; eugenol ; tannin ; acid amides, alanin and asparagine ; uric acid and xantilin as potassium salts and compared with caffeine ; pyridine and piperidine compared with nicotine ; quinine, strychnine and morphine.

In the germination tests the seeds were placed on cotton in galvanised-iron germinating trays the bottom of which was covered with filter paper, and moistened with a solution at 1 per 1 000 strength of each of the above mentioned substances. Mandelic nitrile, eugenol, and mustard oil completely prevented the kidney-beans from germinating ; the other substances

were, however, less toxic for germinating seeds, and, on the contrary, even alanin and strychnine, and, to a less degree, cocaine, atropine, quinine and morphine, caused a germination that was premature in comparison with that of the seeds moistened with water. Vanilline, tannin and asparagine neither retarded nor hastened germination. Mandelic nitrile and strychnine had an antithetic action, considering that, when the seed was moistened simultaneously with both the solutions, some germinated, viz. 3 % for the kidney-bean and 26 % for the lupin.

When the young plants had grown sufficiently, they were given the various solutions at 1 per 1000 strength. It was found that the plants in the galvanised-iron germinating trays suffered less from the toxic substances than those in glass trays and that zinc sulphate hinders the toxic action of the aromatic compounds.

Except mandelic nitrile, the other aromatic compounds used had no specific action on the kidney-bean plants so as to modify their external morphology. On the contrary, however, kidney-bean plants fed exclusively on mandelic nitrile alone or with that substance plus a nutritive solution free from nitrogenous compounds, were shorter and more squat, with the roots less developed, rounder leaves and of a deeper green colour, in comparison with control plants in a nutritive solution. Nevertheless these differences became attenuated as growth continued, disappearing at maturity. The eugenol was very noxious; the saligenine, benzylic alcohol, sodium benzoate and salicylate at first caused some harm, which later disappeared; vanilline and tannin had no effect; alanin and asparagine had a favourable action.

Whilst pyridine and piperidine only result in a darker colour of the leaves, all the vegetable alkaloids properly so-called, which were tried by the authors, had a toxic action. Thus, while caffein (trimethylxanthine) kills kidney-bean plants in 2 days, xanthine and uric acid favour their growth; thus proving that methylic radicals can also cause a strong physiological action in plants, which the fundamental compound entirely lacks. These facts are in contradiction with the opinion of those who consider the alkaloids are excretory products, and the methylic radicals, so common in plant products, as a means of protection for weakening the action of too active radicals such as oxyhydrides or imines. Of all the alkalis used in this research, the least toxic was morphine; quinine was more toxic and strychnine still more so.

According to the authors, the known facts point to the hypothesis that alkaloids have, in the plant organism, a function as yet unknown and undetermined, which might be that of plant hormones. The various species of plants, in order to take advantage of the inutilisable waste products as such, might change their composition so as to make them suited to the specific functions which they should fulfil, just as animals, for example, produce the adrenalin of the supra-renal capsules by means of tyrosine.

As regards the faculty of plants to free themselves of useless or harmful substances, the authors record that on inoculating young maize plants

growing in the open soil with the tartrates of nicotine and pyridine, and by keeping the upper part of the plant closed in a flask whose walls were damped with dilute sulphuric acid, they were able to show that the two alkaloïds left the leaves by transpiration. Admitting that plants are not unprovided with elimination systems; if very active substances are found to be present in them, that signifies that the plant has produced the substance with some definite purpose.

PLANT  
BREEDING

854 - **Selected Wheat in India.** — MACKENNA, J., in *Report on the Progress of Agriculture in India for 1916-1917*, pp. 17-20. Calcutta, 1918.

The improvement of wheat by selection and hybridisation has been steadily studied and has already given excellent results. In the various provinces of India the old native forms are gradually being replaced by more productive new varieties, distinguished by the superior quality of their grain.

*Pusa No. 12*, early, resistant to rust and lodging is very popular among farmers and widely grown in the United Provinces, Punjab (Hoshiarpur, Jullundur, Gurdaspur, and Sialkot districts), as well as in South Bihar.

*Pusa No. 4* does well in Bundelkhand, Central India, and especially in the North-West Frontier Province, where it is much superior to the native types in yield and resistance to rust and lodging.

*Pusa No. 12* and *Pusa No. 101* are successfully grown in the Central Provinces, Southern Circle. In the Northern Circle *No. 13* is preferred in the Nerbudda Valley, *No. 88* in Jubbulpore, and *No. 90* where irrigation is used. Hybridisation work (EVANS) is being continued between the local varieties and an Australian variety with the aim of obtaining types yet more resistant to rust.

At the Pusa Experiment Station, where most of the new wheats come from, Mr. HOWARD is continuing his selection and hybridisation work. At present four series of crosses are being studied, two of which, derived from *Pusa No. 6*, have already given promising results. The work aims at combining in one type to the best advantage, good root development, resistance to rust and lodging, good quality grain, and a high yield.

The selected wheat *Punjab 11* is being grown more and more in the irrigated districts of the Punjab. Owing to the good quality of its grain and its high yield, this wheat assures the farmer a good profit. *Pusa No. 12* is grown in this district as well as *Punjab 11*.

In the United Provinces Mr. LEAKE has evolved a new variety, *Cawnpore No. 13*, with very strong straw and grain of good milling qualities.

855 - **Selection of Native Oats and Barley in Norway.** — CHRISTIE, W., in *Aarsberetning angaaende de offentlige foranstaltninger til landbruks fremme i aaret 1916*, pp. 481-525 + 2 Tables. Christiania, 1917.

The varieties of cereals selected in England, Denmark, and Germany cannot be cultivated in Norway because of its different weather and agrogeological conditions; they have been repeatedly tested but have always given negative results on account of their lateness. Good results have, however, been obtained with some of the best types from Svalöf (Sweden), de-

rived from the hybridisation of selected varieties with local ones characterised by their earliness and resistance to cold. Thus, for example, in 200 cultural tests in various districts white Guldregn oats (1) always gave excellent yields of grain and straw. All the Svalöf varieties are, however, very exacting as regards soil, and when sown in the shallow, sand or peat soils so common in Norway they tiller little and yield less than the native Romerike, Trönde, Hedemarken and Vestland varieties. It is, therefore, necessary to select the native types so as to improve them and fix new strains with well marked, stable characters, capable of being crossed with the productive, ultra-selected foreign varieties.

Norwegian oats and barleys include numerous forms differing in yield, strength of straw, earliness, etc. Selection of the best elements is sure to lead to the formation of groups with valuable characters, better developed and superior on the average to the native varieties both in yield and earliness. The paper under review gives the results of pure-line selection of Norwegian oats and barley.

OATS. — In 1905, 127 Hedemarken plants were selected at Vindju, in Ringsake, and, in 1906, 170 plants of the same variety in different parts of the province of Furnes. It should be noted that among the native oats there frequently occur forms of the Propsteier type which was previously largely cultivated in this district. During the years following the first selection a comparative study of the various strains was made and the least promising ones eliminated, thus gradually reducing the number of plants in 1912 to 4 only *i. e.*, 2 from the 1905 selection and 2 from the 1906 selection. The names of the new varieties and the numbers in which they are inscribed in the genealogical register are: — Möistad Grenader, 34, Möistad Odin 0200, Möistad Perle 160, Möistad Thor 0207. During five years they have been subjected to comparative cultural tests with the native Hedemarken variety and the Swedish oats Guldregn and Mesdag. The grain yields (cwt. per acre) are given in Table I.

TABLE I.

	Möistad Grenader 34	Möistad Perle 160	Möistad Odin 0 200	Möistad Thor 0 207	Hede- marken (native)	Guldregn (Swedish)	Mesdag (Swedish)
In soil uncultivated the previous year .	20.47	20.78	24.61	24.61	22.30	21.26	19.67
In soil previously ma- nured and planted with potatoes . .	24.37	20.63	24.29	23.65	21.26	22.78	18.95

In rich soil previously fertilised and planted with potatoes Grenader and Odin did best, but in soil not cultivated the previous year Thor and

(1) See *B.*, 1912, No. 1030. (*Ed.*).

Odin took first place. In all cases Odin yields best. The results obtained are shown in Table II.

TABLE II. — *Results of comparative cultural experiments with different varieties of oats and barley at Hjellum and Møistad.*

	Duration of vegetative period (1) days	Resistance to lodging (2)	Yield in grain per acre cwt.	Relative index of yield in grain	Weight of 1000 grains gm.	Percentage of hulled grain	Yield in straw per acre cwt.
<i>Oats:</i>							
Grenader 34 . . . . .	108	1.2	20.47	83	48.59	77	34.09
Perle 150 . . . . .	97	1.4	20.78	84	34.65	73	31.69
Odin 0200 . . . . .	107	1.9	24.61	100	45.24	74	33.93
Thor 0207 . . . . .	105	2.8	24.61	100	39.22	68	34.52
Hedemarken (native)	104	3.7	22.30	91	35.21	70	34.48
Guldregn (swedish) . .	105	1.6	21.26	86	42.24	76	36.63
Mesdag (swedish) . . .	(98)	3.2	19.67	80	(34.56)	(72)	27.95
<i>Barley:</i>							
Mjøs . . . . .	90	3.00	18.63	100	43.63	—	27.31
Maskin . . . . .	86	1.25	17.92	96	38.23	—	21.90
Bamse . . . . .	88	3.16	17.12	92	37.39	—	25.09
Hedemarken (native)	89	4.00	17.28	93	35.81	—	25.17

(1) Number of days from sowing to harvest. — (2) This resistance is expressed according to an empirical scale ranging from a maximum of 1 to a minimum of 4.

The results are very satisfactory for all the characters considered and the four new varieties are very superior to the original ones. The resistance to lodging (1.2) of the Grenader variety is nearly three times that of the Hedemarken variety (3.7). The vegetative period of the Perle variety does not exceed 87 days. The varieties Odin and Grenader surpass even the Swedish Guldregn variety in the weight of 1000 grains. Finally, in percentage of naked grain Grenader again leads with 77 %, exceeding Guldregn by 1 % (76). The data on the four new varieties may be summarised as follows: —

1) *Grenader 34*. — Comes first for resistance to lodging, percentage of hulled grain and, in rich, fertilised soil, yield in grain. The bright yellow grain is of the Propsteier type, short, compact, and plump. This variety has been put on the market since 1917.

2) *Odin 0200*. — A very productive variety, not only in Hedemarken, but also in the province of Romsdal. Grain of the Propsteier type. On the market since 1917.

3) *Thor 0207*. — In the provinces of Hedemarken, Romsdal and Trøndelag this variety is very productive, even in very poor soils and has at the same time a high resistance to lodging. It is certain to be largely used in Norway owing to its capacity of adapting itself to unfavourable weather

and agro-geological conditions. White grain of the Norwegian type, large and plump. Will be put on the market in the spring of 1919.

4) *Perle 160*. — Remarkable for its earliness which even exceeds that of the Swedish Mesdag oats, famous for this quality. It is equal to Odin and Guldregn in its resistance to lodging. Grain pearl white of the white Norwegian type, very short; a little inferior in dimensions to the common Hedemark oats, but has a higher percentage of hulled grain. This variety cannot be put on the market for 3 or 4 years.

**SIX-ROWED BARLEY**. — Taking as a basis the considerations given above for oats the author made a first selection of 85 barley plants in 1905, and, in 1907, a second selection of 232 plants in the districts of Biörneby, Alu, Trysil, Lom, Hovinsholm, and Helgeöen. A series of comparative tests with the elimination of the more unpromising plants reduced the number of strains to two good new varieties *Miös* and *Maskin* — designated in the genealogical register by the numbers 08 and 077. The results obtained are compared in Table II with those of Bamse barley and unselected common Hedemarken barley. The results were distinctly positive, for the two varieties surpassed the original ones, especially in yield in grain and resistance to lodging. The two varieties may be described as follows: —

*Miös* 08 is distinguished by vigorous growth, high yield in grain and straw and size of grain. In earliness and strength of straw it is, however, equal only to common barley. It was put on the market in the spring of 1917.

*Maskin* 077 is remarkable for earliness (it ripens three days before common barley) and resistance to lodging; it also gives good yields.

**856 — Pure-line Selection of Oats and Barley in Quebec, Canada.** — MURRAY, JAMES, in *The Agricultural Gazette of Canada*, Vol. V, No. 2, pp. 163-165. Ottawa, February, 1918.

By individual selection the author succeeded in isolating strains of Joannette oats differing in many ways from the parent plant; these strains are Nos. 407, 607, 2 007, 2 707, and 3 307. The data given below are the averages of a five-year period.

The *duration of the vegetative period* for Joannette is, on the average, 99.2 days; No. 2 007 is, however, much earlier, 94 days; No. 407 is much later than the original variety, 105.6 days.

The *percentage of hull*, 26.9 for Joannette, is 28.8 for No. 2 007 (an undesirable character), but drops to 24.4 for No. 3 307.

*Yield in grain.* — Joannette yields 59.67 bus. per acre; it is exceeded only by No. 607 which yields 70.09 bus; all the other strains are more or less inferior to the original variety.

Still more satisfactory results were obtained with Mandscheuri barley, as is seen by the five-year averages for the original variety and the selected strains Nos. 6 809, 7 008, 7 408.

Duration of vegetative period

Bushels of grain per acre

86.8 days	52.84
86.8 "	69.95
84.6 "	66.69
86.2 "	67.29

The pure strains give a higher yield than the original variety and one is equally early, whereas the two others are earlier.

**857 - Experiments in the Hybridisation of Maize, in the Philippines.** — MARQUEZ, I. D., in *The Philippine Agriculturist and Forester*, Vol. VI, No. 4, pp. 116-123. Los Baños (Laguna), December, 1917.

Maize hybrids are often more vigorous and more productive than the parent plants, so that hybridisation may be advantageously carried out whenever similar varieties are available so that, when crossed, they give uniform and homogenous progeny. The author made the following crosses: —

- I) First Prize Mestizo (357  $F_2$ ) ♀ × Iowa Ideal (1490  $F_1$ ) ♂
- II) White Flint Moro (2581) ♀ × Pasig White Flint (2298) ♂
- III) Pasig Yellow Flint (2802) ♀ × Old College Yellow Flint (184  $F_4$ ) ♂
- IV) Bay Moro White Flint (3149) ♀ × Native Yellow Flint (3150) ♂
- V) Pure Moro White Flint (3163) ♀ × Bay Moro White Flint (3145) ♂.

The Cross IV, between white and yellow varieties, gave lemon colour hybrids which yielded 21.5 % more than the Native Yellow Flint. The results of Cross V were also very good, the yield of the hybrids exceeding that of the parents by 15.4 %.

**858 - Lint Percentage and Lint Index as Important Factors in the Selection of Cotton Varieties.** — See No. 866 of this *Review*.

**859 - Investigations into the Colour of the Fruit in Hybrids of Tomato, Aubergine and Pepper, in the United States.** — BYRON, HALSTED D., in *The Journal of Heredity*, Vol. IX, No. 1, pp. 18-23. Washington, 1918.

**TOMATO** (*Solanum Lycopersicum*). — The pulp of the fruit may be either lemon colour (y), or red (R); the tegument may be of an orange shade (o), or colourless (o). The characters O and R are dominant, y and o are recessive. There may be four different combinations:—

- 1) yellow pulp and colourless tegument : yellow fruit. yyoo
- 2) " " orange " orange " yyOo
- 3) Red " " colourless " pink " RRoo
- 4) " " orange " red " RROO

The cross 1 × 2 gives, in  $F_1$ , hybrids all of which have orange fruit (yyOo) as a result of the dominance of O, and in  $F_2$   $\frac{3}{4}$  of individuals with orange fruit and  $\frac{1}{4}$  with yellow fruit, in accordance with the ratio 3:1.

Similarly the cross 3 × 1 gives an  $F_1$  composed entirely of pink-fruited hybrids (Ryoo), and an  $F_2$  including three pink-fruited plants. RRoo, Ryoo, yRoo and one yellow-fruited plant yyoo.

The cross 3 × 2 is less simple. In  $F_1$  the two dominant characters combine so that all the fruit is of a different colour from that of the parents. i. e., red, RyOo. These hybrids produce four kinds of gametes — RO, Ro, yO, yo — which combine in  $F_2$  in 16 different ways, as is seen by the appended figure, giving plants with red, pink, orange and yellow fruit respectively in the ratio 9:3:3:1.



		Male gametes of $F_1$			
Females gametes of $F_1$	♂	R0	Ro	y0	yo
	♀				
	R0	RR00 (red fruit)	RR0o (red f)	Ry00 (red. f)	Ry0o (red t.)
	Ro	RR0o (red f.)	RRoo (pink f.)	Ryo0 (red f.)	Ryoo (pink f)
	yo	yRR0 (red f.)	yR0o (red f)	yy00 (orange t.)	yy0o (orange f)
	yo	yR0o (red f.)	yRoo (pink f.)	yyo0 (orange f.)	yyoo (yellow f.)

 $F_1$ 

Crosses between type 4 and the others gave the following results:—

a) Cross 4 × 1 (*red* fruit × *yellow* fruit):— All the  $F_1$  hybrids have red fruit:  $F_2$  behaves as in the cross 3 × 1 (see Figure).

b) Cross 4 × 2 (*red* fruit × *orange* fruit): The  $F_1$  hybrids all have red fruit (Ry00); they produce two sorts of gametes — R0 and y0 — which can combine in  $F_2$  in four different ways, three giving red fruit RR00, Ry00, yR00 — and one giving orange fruit — yy00 — so that  $\frac{3}{4}$  of the  $F_2$  plants have red fruit, and  $\frac{1}{4}$  orange fruit. The hybrids RR00 and yy00 remain constant, whereas Ry00 and yR00 continue to divide into plants with red fruit and those with orange fruit, in the usual ratio.

c) Cross 4 × 3 (*red* fruit × *pink* fruit): this case is similar to the preceding one except that in the cross *red* × *orange* the constant character is that of the tegument (00), whereas here (*red* × *pink*), it is that of the pulp (RR).

AUBERGINE (*Solanum Melongena*). — The most common colour of the fruit is purple, which, however, varies greatly in the different varieties, as may be seen from a comparison between the varieties Black Beauty and Dwarf Purple. In some cases this colour occurs beneath the calyx, in others only in these parts of the fruit exposed to the sun. There are, therefore, two pigments, distinguished by their manner of reacting to light. The fruit of plants which do not contain the factor determining the purple colour have a colourless tegument, and the ripe pulp may be either ivory white or green. There are, then, four cases to be considered:— a) green pulp; b) white pulp; c) purple tegument; d) colourless tegument. The characters "purple" and "green" appear to be dominant. Four combinations are possible;—

- 1) Green pulp and purple tegument: GGPP
- 2) White " " " " : ggPP
- 3) Green " " colourless " : GGpp
- 4) White " " " " : ggpp.

The cross 1 × 2 gives, in all the generations, hybrids with constantly purple tegument. On the other hand, in  $F_1$  the pulp of the fruit is always

green, whereas, in  $F_2$   $\frac{3}{4}$  of the plants have fruit with green pulp (GG; Gg gG) and  $\frac{1}{4}$  fruit with white pulp (gg) in the usual ratio of 3 : 1.

In the cross  $1 \times 4$ , or GGPP  $\times$  ggpp, the hybrids of  $F_1$ , with the formula GgPp produce 4 kinds of gametes — GP, Gp, gP, gp. — which combine in 16 different ways, giving in  $F_2$  9 plants with green pulp and purple tegument (purple fruit), 3 plants with white pulp and purple tegument (pink fruit), 3 plants with green pulp and colourless tegument (green fruit); 1 plant with white pulp and colourless tegument (white fruit). These combinations give a figure similar to that for the tomato. These theoretical results may be obtained by crossing the variety Long White (white fruit) and the variety Dwarf Purple (purple fruit).

Besides the four types already discussed there is another with variegated fruit. When this is crossed with a white-fruited variety hybrids with slightly variegated fruit are obtained in  $F_1$ , but when it is crossed with a purple-fruited variety the hybrids of  $F_1$  have purple fruit, and in  $F_2$  most of the plants have purple fruit and only a few have variegated fruit, showing this second character to be recessive.

PEPPER (*Capsicum* spp.) — Before ripening the fruit may be light or dark green, when ripe, red or orange (red being dominant). In some cases, at the period of ripening, instead of an immediate change from green to red or orange, intermediate colours occur, such as a bright lemon colour, turning first to orange, then to red. In this case the more or less ripe fruit has many shades varying from green in the parts not exposed to the sun, to orange and red. This colour variation is due to a genetic factor which, at the time of ripening, determines the regular and immediate passage from green to red or orange. The most common colour combinations are: — 1) lemon and orange; 2) green and orange; 3) orange and red; 4) green and red.

Some pepper plants have a purple pigment especially in the nodes and stem, but sometimes in the flowers and fruit. Before ripening this appears black. Little is as yet known on the inheritance and genetic value of this character.

To sum up, in all the species considered the colour of the fruit tends to be yellow or red. In the tomato and aubergine the colour of the tegument is the fundamental character in selection and hybridisation tests. In the pepper plant various chromatic factors occur before the ripening phase, some of which are very similar to those of the aubergine. The purple colour occurs particularly in the fruit of aubergine. It is also common in that of pepper, but less marked in tomatoes. In each case it is very sensitive to the action of external agents.

CEREAL  
AND PULSE  
CROPS

860 — **The Cultivation of Cereals in Spain.** — I. QUINTANILLA, G., Cultivation of Cereals in New Castile, in *Boletín de la Asociación de Agricultores de España*, Year X, No. 105, pp. 64-84, Madrid, February, 1918. — II. DANTIN, CERECEDA, J., Experiments in the Dry Farming of Cereals in Spain, in *Boletín de Agricultura técnica y económica*, Year X, No. 112, pp. 316-325, Madrid, April, 1918.

I. — **CULTIVATION OF CEREALS IN NEW CASTILE.** — The great obstacle to an increased cereal production in this district is the climate (1). In

(1) See R July, 1918, No. 725. (Ed.)

the provinces of Guadalajara, Cuenca and Madrid there are frosts every year from November to April or May: in that of Toledo, from November to March. During the last 15 years the minimum and maximum temperatures were  $-6.5^{\circ}$  and  $+40.4^{\circ}$  C respectively in the province of Toledo,  $-12.5^{\circ}$  and  $+38.5^{\circ}$  in that of Cuenca,  $-13^{\circ}$  and  $+39.6^{\circ}$  in that of Guadalajara, and  $-14^{\circ}$  and  $+40.5^{\circ}$  in that of Madrid. The differences are, therefore, considerable, and to these are added another unfavourable factor — snow during 8 or 9 months of the year. This accounts for the low yields. During the 10 years, 1903-1912, the average yields, in cwt. per acre, were: — Toledo, wheat 6.30 (this average, which is very low, includes the yield of irrigated wheat), barley, 13.38; oats, 9.55; rye, 4.38; Cuenca, wheat, 4.93; barley, 9.55; oats, 4.38; Guadalajara, wheat, 6.56; barley, 8.36; oats, 6.66; rye, 7.44; Madrid, wheat, 8.36; barley, 13.14; oats, 7.16; rye, 6.37. For the whole of New Castile the averages were: — wheat, 6.28; barley, 11.53; oats, 6.29; rye, 6.03. It is seen that all these yields are low.

On the other hand, rain is plentiful and well distributed — 361, 477, 410, 417 mm. for the provinces of Toledo, Cuenca, Guadalajara and Madrid respectively.

There are three soil types in New Castile: — 1) that from decomposing rocks, very silicious with only 6 % to 7 % of clay, and containing only 0.5 % to 5 % of lime (the larger amount in the Moucloa district), 0.6 % of phosphoric acid, but up to 6 % of potash; 2) calcareous soil not used for crops; 3) soil derived from feldspathic rocks with more than 1 % of phosphoric acid, containing a fair amount of potash and nitrogen, but heavier than the soil of class 1.

In the experimental plots of the Agricultural Station of Alcalá de Henares the author found 12 to 14 % of moisture at a depth of 23  $\frac{1}{2}$  inches, and 9 to 11 % at the surface. There are also, however, at the Station sandy soils nearly 5 feet deep, which, at 2 feet, have barely 5 % of moisture so that plants can derive little from it. Experiments made at the Station showed that soil 5 feet deep and, if slightly heavy, 3  $\frac{1}{4}$  feet deep, is suitable for cultivation (according to WIDTSØE the requisite depth for sandy soils in the United States is 9.84 feet).

Judging by scientific observations and his own experience as a farmer, the author does not advise for the "Meseta Central" (central table-land) of Spain the dry farming methods usually recommended for dry soils, because he observed that in this district they dry up the soil instead of preserving its moisture. Instead he advises a single preparatory ploughing, as deep as possible, care being taken not to turn the sub-soil onto the surface.

The most satisfactory fertilisers are phosphatic and nitrogenous ones; as a rule little potassic fertiliser is required.

In view of the great climatic variations from one year to another it is impossible to lay down rules for the best time for sowing, but at any rate it should be sufficiently early to avoid injury from late frosts. With regard to the quantity of seed, in many parts of New Castile 187 lb. or more per acre are used. Cultivation consists of one or two hoeings to destroy weeds.

The author studies the different American wheats which, on the whole,

are adapted neither to the particular climatic conditions nor to the soil of New Castile.

II. — EXPERIMENTS ON THE DRY FARMING OF CEREALS IN SPAIN. — The author refers to the work done by Señor José Cascón at the "Granja agrícola" of Palencia and by Señor QUINTANILLA at the Miralcampo farm near Azuqueca, Guadalajara. The former concluded that the factor determining the quantity of seed to be used is not the nature of the soil, but the climate. At Palencia, where the average annual precipitation is 399 mm. the best quantity is 1.4 bushels per acre. With this quantity and good cultural methods the Agricultural Station of Palencia obtained, as a nine-year average, 21.38 cwt. of wheat per acre, or 3.27 times more than the average production (hardly 6.53 cwt.) for the whole of Spain (1). The amount of seed commonly used is excessive and sometimes exaggerated.

For more than a century excellent Spanish agriculturists have tested and recommended sparse sowing. AUGUSTÍN CORDERO tested it near Madrid on behalf of the "Real Sociedad económica Matritense" and, in 1771, obtained for wheat, using 0.92 bushels of seed per acre, 18.88 bushels of grain; in 1772, with 0.74 bushels of seed, he obtained 21.88 bushels of grain. The seed was sown in lines in three rows with a space of one unsown line. In 1773, also with sparse sowing, he obtained 59.27 bushels per acre of barley using 1.96 bushels of seed, and 43.18 bushels of grain with 1.4 bushels of seed. The results of his experiments led him to recommend sowing in pockets, four seeds to each, in squares 1 foot apart leaving 1 line unsown to every 3. He based his calculations for the number of seeds to use on the work of VALCÁRCEL, who had already determined the number of seeds per unit of weight. In 1818 this method was confirmed and recommended by Prof. ARIAS Y COSTA in his text-book entitled *Lecciones de Agricultura explicadas en el Jardín botánico* (Madrid, 1818).

861 — **Yields of Spring Grains in Illinois.** — BURLISON, W. L., and ALLYN, O. M., in *The University of Illinois, Agricultural Experiment Station, Bulletin*, No. 195, pp. 499-508. Urbana, Illinois, January, 1917.

Spring grains form a large proportion of the crops produced in Illinois. Owing to the marked climatic and soil differences in the State, varieties suited to one district are not necessarily desirable in another. The experiments described were carried out to determine the varieties best adapted to northern, central and southern Illinois, as represented by the experiment fields at Dekalb (Dekalb County); Urbana (Champaign County); Fairfield (Wayne County). The methods of culture used were similar to those of the corn belt.

(1) According to Prof. MARRO (*Corso generale di Economia*, Vol. II, p. 152, Rome, 1906) the average wheat yield in Spain is 17.5 bushels per acre. According to Señor GUMERSINDO FERNANDEZ DE LA ROSA during the last 20 years, on an average about 10 of the 40 million acres of the arable land of Spain have been used for wheat, with an average annual yield, according to official statistics (which he considers higher than the actual yields), of over 115 1/2 million bushels, or 13.17 bushels per acre (*Revista de Montes*, Year XLII, No. 992, pp. 338-339. Madrid, May 15, 1918). (Ed.)

**NORTHERN ILLINOIS.** — (Soil : brown silt loam ; rainfall : 33.64 inches per year) : — The rotation was chiefly maize, maize, oats, and clover, but tests were also made with oats, spring wheat and barley in the rotation maize, oats, spring wheat and clover.

*Oats.* — Of the varieties tested for 6 years Silvermine, Schoenen and American Banner gave the highest yields with an average of 64.0, 63.3, 61.1 bushels per acre respectively. Great American, Scottish Chief and White Kherson (Iowa 103), tested for 2 years only, gave very satisfactory yields (70.8, 70.2 and 68.6 bushels per acre respectively). Tests made over 6 years with northern oats and home-grown oats showed that the first produced an average of 3.0 bushels per acre more than the second ; this difference is not sufficiently great to justify the extra expense incurred by shipping northern seed oats.

*Spring wheat, barley, rye and emmer.* — The tests with these cereals have been too limited to justify any conclusions as to the relative value of the varieties.

**CENTRAL ILLINOIS.** — (Soil : brown silt loam ; rainfall : 35.76 inches per year). — The crops were grown in two rotations, 1) maize, maize, oats or other spring grain, and clover ; 2) wheat, maize, oats and clover.

*Oats.* — The best varieties tested over a number of years were :—

Variety	Average yield (bushels per acre)	Variety	Average yield (bushels per acre)
Sixty Day (11 yrs.). . . . .	58.1	Irish Victor (11 yrs.) . . .	49.9
Swedish Select (6 yrs.) . . .	54.6	Silvermine (8 yrs.). . . . .	49.2
Schoenen (9 yrs.). . . . .	51.1	Siberian (13 yrs.) . . . . .	49.0
White Bonanza (12 yrs.). . .	49.9	American Banner (13 yrs.).	47.0

The most promising of the varieties grown over 2 years only were : — Great American (72.1 bushels per acre), Yellow Kherson (Iowa 105) (68.9 bushels per acre), Big Four (68.8 bushels per acre), and Wisconsin Pedigree No. 1 (67.9 bushels per acre).

*Spring wheat.* — This crop is not ever likely to become important in Central Illinois, though it offers possibilities, especially where there is a danger of winterkilling. The results obtained in 1916 were : — Spring (a home-grown variety), 27.9 bushels per acre ; Durum, 24.6 bushels per acre ; Marquis, 21.8 bushels per acre ; Red Fife, 18.3 bushels per acre.

*Barley.* — Common barley, with a 5 year average of 40.1 bushels per acre, seems the most promising of the varieties tested. It is very similar to Oderbrucker, which gave a 4 year average of 38.1 bushels per acre. The trials carried out so far are, however, insufficient to give any definite results.

**SOUTHERN ILLINOIS.** — (Soil : grey silt loam on tight clay ; rainfall : 40.25 inches per year). — Climatically southern Illinois is not well adapted to spring cereals, though, in favourable seasons, fair yields may be obtained. Texas Red and the early varieties of oats give better results than the late varieties.

The bulletin concludes with a table setting out the characteristics of the varieties of oats tested.

862 - **Researches on the Gases of Swamp Rice Soils, in India.** — See No. 843 of this *Review*.

863 - **The Recurving of Milo and Some Factors Influencing It.** — CONNER, A. B. and KARPEN, R. E., in *Texas Agricultural Experiment Station, Bulletin* No. 204, 30 pp. + 10 Tables + 13 Figs. Austin, Texas, February, 1917.

Recurving or "goosenecking" in milo and certain other sorghums is undesirable on account of impracticability of harvesting the crop with machinery, and the probable reduction in yields by loss of heads during the early stage of development.

Climatic conditions at the Lubbock station, where experiments were conducted, were very favourable to the study of the fundamental cause, or causes, of recurving and the factors influencing it.

Tallness or dwarfness in the same strain is the result of lengthening or shortening of the internode. No apparent difference was observed in the tenderness of the peduncle of different grain sorghums at similar stages of development. In every case noted the normal inclination of the peduncle was toward the side of the leaf sheath opening. The removal of a vertical section of the back of the upper leaf sheath, however, always resulted in complete recurving of the peduncle in the direction of the opening, this fact indicating that the support from the leaf sheath alone controlled the direction in which the head inclined. Dwarfness in stature is associated with a high percentage of erect heads, while tallness is attended by a high percentage of pendant heads. Rapid growth of the plant is conducive to tallness, while slow growth is conducive to dwarfness. Root-pruning and consequent limitation of food supply increased the number of erect heads and decreased the number of pendant heads. Limitation of moisture and food of individual plants, by reducing the feeding area per plant, resulted in an increase in the number of erect heads and a decrease in the number of pendant heads. Measurements of internode and sheath lengths in both milo and kafir have shown that while the internode varies widely under different environmental conditions, the sheath length remains quite stable. A shortening or a lengthening of the internode without a corresponding change in the length of the sheath results in the sheath's overlapping the internode in varying degrees when the same plant is grown under different conditions. Long overlapping of the sheath undoubtedly lends support to the stem, including the peduncle, while a short overlapping of the sheath lends correspondingly little support. The removal of the inrolled sheath tip before any part of the head appeared resulted in increasing the percentage of erect heads. It seems conclusive that in milo a tightly inrolled upper leaf sheath tip influences the position of the head. Plants of tall stature showed a long inroll, as compared with dwarf plants, and long inroll of the upper sheath seems to be associated with a large number of pendant heads.

864 - Important Root Crops of the Philippines. — KINGMAN, F. C. and DORYLAND, E. D., in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 410-433. Manila, 1917.

The following plants are largely cultivated throughout the Archipelago, usually as secondary crops. Their produce is on the market all the year round, and though the total production is unknown, they play an important part in the food supply of the population.

GINGER. — It is of good quality and consumed entirely locally. Besides *Zingiber officinale* 4 other varieties are cultivated. The yield per acre is from 4.77 to 7.16 metric tons of roots which lose 70 % of their weight when dried. It is sold coated or uncoated and scraped (decorticated when fresh and dried; this is "white ginger"). Ginger ale is made from a water extract of dried ginger root mixed with sugar, lemon juices, and yeast.

ARROWROOT. — Although all the different species used in the manufacture of arrowroot (*Maranta arundinacea*, *M. nobilis*, *Manihot utilissima* [cassava], *Canna Achiras*, *C. edulis*, *C. flaccida*), except *Maranta nobilis* and *Canna Achiras*, are grown in the Philippines, only *Maranta arundinacea* and *Tacca pinnatifida* are used largely. The former occurs wild in some localities. Under favourable conditions it yields 4.98 metric tons of roots per acre, which, with the local, crude processes of manufacture, yield 15 % of starch. The latter plant grows wild, especially near the coast.

CASSAVA. — There are many varieties in the Philippines, both bitter (*Manihot utilissima*) and sweet (*M. Aipi* = *M. palmata*), but they are not named. The average yield per acre is at least 9.95 tons of fresh roots containing 25 to 30 % of starch, 80 % of which is extracted by modern methods. Cassava does best in sandy soil, alone, at intervals of one year, in squares, or with a leguminous crop (cowpeas or mungos, etc.) between the lines, which should then be 5 feet apart. All the roots (sweet and bitter) contain hydrocyanic acid, which is removed by washing, drying, roasting or prolonged boiling. The roots are best for human food between 6 and 9 months after harvest.

SINCAMAS (*Pachyrrhizus erosus* = *P. angulatus*). — A Leguminous vine, which has become acclimatised and grows wild in the Philippines. It is propagated from seed sown sparsely in rows about 23 inches apart, allowing from 15 to 20 seeds to the metre (3.28 feet). The plant matures completely in about 2 years, but is harvested 5 or 6 months after sowing, i. e., when the root, which is the edible part, is still tender and not yet fibrous. The yield is about 6 tons per acre.

ELEPHANT EAR PLANT (*Colocasia esculentum* = *C. antiquorum*), known locally as "gabi". The edible part is the starchy, acrid stalk, or corm, the acrid constituent of which is removed by boiling. The average yield is about 23 *cavans* (46.86 bushels) per acre.

Some years ago the Bureau of Agriculture of the Philippines made a collection of 21 species and varieties of gabi, most of which had to be discarded because of their liability to fungoid diseases.

SWEET POTATO (*Ipomoea Batatas*). — The sweet potato is known in the Philippines by the Mexican name of "Camote" under which it was

introduced centuries ago. There are several good-producing native varieties, but none of them are equal to the best varieties imported from North America, the best of which are New Jersey Yellow, known locally as Momingan, New Jersey Red, and California Large White. The second variety holds the record for productivity, having yielded 256.78 cwt. per acre. In the Philippines the sweet potato is propagated by cuttings from young vines or, in sandy soil, by planting whole or half potatoes. When transplanting the plants are placed in the centre of the ridges (flat-ground planting gives low yields and bad-shaped roots, as was shown at the Singalong Agricultural Station). The best time for planting is towards the end of the rainy season, but if irrigation water is available the potatoes may also be planted during the dry season. Cultivation consists in working with a cultivator, followed by hoeing; it is rarely necessary to repeat the process. The most common diseases are mosaic disease, due to physiological causes, and rots of the tuber during storing. The most injurious insect is *Cylas formicarius*, which lays its eggs near the collar. The larvae bore holes in the root, where they pupate. Control measures consist in early harvesting, rotation, and the burning of all root refuse.

**YAM.** — In 1912 the Philippine Bureau of Agriculture collected 116 species and varieties of the genus *Dioscorea* from all parts of the Tropics, and cultivated them for several years. The 96 which became acclimatised were subjected to a complete chemical analysis, and to growing and feeding tests. Only 34 (10 varieties of *D. fasciculata*, 18 *D. sp.*, 1 *D. Daemona*, 4 *D. alata*, 1 *D. aculeata*) were considered adapted to Philippine conditions. These are being propagated for distribution purposes at the Agricultural Station of Lamao, Bataan.

*D. fasciculata* grows wild in some parts of the Philippines. Propagation is by tubers or crowns of tubers in lines 2.36 to 3.28 feet apart at distances of 3.28 feet; trellises are erected later. The roots are harvested 7 to 9 months after planting. The production is equal to or better than that of the best varieties of sweet potato; some of the larger varieties yield nearly 23 metric tons per acre, but as they are difficult to harvest they are rarely grown.

A table is given showing the results of analyses made by the Bureau of Science of Manila of the roots of 96 species and varieties of *Dioscorea* grown in the Philippines. In most cases the tubers weigh about 500 gm. and contain about 70 % of water, 0.2 % of ether extract, 0.3 % of saccharose, 0.4 % of reducing sugar, 2 % of protein, less than 1 % of ash, about 20 % of starch, less than 1 % of fibre, and about 5 % of undetermined substances.

Owing to the difficulties of the present times cotton growing in Algeria is still localised in the Orleansville and Oranie districts. Nevertheless, very good results have been obtained. The only varieties cultivated



are derived from Egyptian cotton and the product, which is very good, commands high prices.

Two varieties selected by the Botanical Department from seed from the Yuma Station, California, have given good results.

The "Yuma" variety, selected from Mit-Affi, yielded at Orleansville 16.9 cwt. of raw cotton per acre. Under the same conditions Mit Affi yielded 13.5 cwt. per acre. At present prices a yield of 13.5 cwt. gives fibre worth £56 per acre. No other crop can give such good results in the Chélif plain.

At the Ferme-blanche Experiment Station the best results were obtained with a variety called temporarily "California", which proved there superior to Yuma, especially in earliness. This variety seems well suited to the soil and climate of North Africa.

For some years Egyptian planters have suffered much loss through injury done by the larvae of *Gelechia gossypiella*, which attacks the pods. The larvae hibernate in the seed and may be carried in it. As disinfection experiments with the seed gave unsatisfactory results, it is most important that no more seed should be imported from Egypt. At present sufficient selected seed is produced in Algeria to meet the local requirements. The Co-operative Society of Orleansville, the Cotton Association of Oran and the Ferme-blanche Experiment Station at Habra, are in a position to supply all the demands for seed in Algeria, Tunis and Morocco.

**866 - Lint Percentage and Lint Index of Cotton and Methods of Determination; Investigations in the United States.** — MELOV, G. S., in the *U. S. Department of Agriculture, Bulletin* No. 644, pp. 1-12 + 2 Figs. + 4 Plates. Washington, January 18, 1918.

The danger of diminishing the vitality and earliness of varieties of cotton by breeding those with undesirable characters by over-emphasising the percentage of lint as a measure of their comparative values was pointed out in 1908 by Mr. O. F. COOK (1). It has been suggested that instead of the percentage of lint only, the weight of lint ginned from 100 seeds should be used as an additional standard for judging varieties. This standard of comparison was called the lint index. Subsequent experience has shown not only the desirability of using this standard, but has also led to improved methods and apparatus for determining the lint index and the lint percentage in samples of seed cotton used by selectors.

The lint percentage is the ratio between the weight of the fibre and the weight of the seeds from which the fibre is ginned expressed as a percentage of the unginned seed cotton. The buyers of seed cotton were the first to use this lint percentage. It should be very carefully used if adopted by breeders and growers as a measure of the comparative value of varieties as it is misleading unless used in connection with the lint index.

An increase in the lint percentage may be due entirely to a reduction in the size of the seed without any corresponding reduction in the amount of fibre, and vice-versa.

(1) COOK, O. F., *Danger in Judging Cotton Varieties by Lint Percentages*. *U. S. Dept. Agr., Bur. Plant Industry, Circ. No 11*, pp. 16. 1908. (Author).

The lint index is a measure of the abundance of the fibre rather than the measure of the ratio between the weight of the fibre and the weight of the seed, as for the percentage of lint.

The lint index shows the number of seeds and consequently the number of bolls, producing 1 lb. of fibre. The number of seeds and bolls required to produce 1 lb. of fibre is constant for all varieties of cotton having the same lint index regardless of the percentage of lint.

An increased lint index corresponds to an increase in the weight of the seeds and reduces the number of bolls required to produce 1 lb. of fibre.

The lint index is an important factor in the cost of production of cotton. An increase of a single gram in the weight of fibre per 100 seeds, without any change in the lint percentage, reduces the labour of picking cotton, thus increasing the amount picked by each worker. It is essential that a planter should know the lint index of a variety as well as the lint percentage when choosing a variety to be planted.

#### METHODS FOR DETERMINING THE LINT INDEX AND THE SEED WEIGHTS.

— After having weighed a standard sample of 100 gm. of seed cotton and determined the percentage of lint, which is the actual weight of the lint, the lint index and the weight of 100 seeds are obtained by the following formulae: —

$$\frac{\text{Percentage of lint}}{\text{Number of seeds in sample}} \times 100 = \text{lint index.}$$

$$\frac{\text{Percentage of seed}}{\text{Number of seeds in sample}} \times 100 = \text{weight of 100 seeds.}$$

The lint index may be determined as follows: — 100 average seeds fairly ginned are weighed on a sensitive balance, or still better, the average weight of two lots of 100 seeds is determined. The following formula may then be used: —

$$\frac{\text{Weight of 100 seeds}}{\text{Percentage of seed}} \times \text{lint percentage} = \text{lint index.}$$

A method is described by which the lint index and the size of seeds of a variety of cotton may be determined without a balance by means of tables given in the bulletin. A description is also given of a balance for the direct reading of the lint percentage. This balance is on the market.

867 - **The Cultivation of Gombo as a Textile Plant; Experiments in Mexico.** — *La Revista agrícola, Órgano oficial de la Dirección de Agricultura, Secretaría de Agricultura y Fomento*, Vol. 1, No. 10, pp. 398-400 + 2 Figs. Mexico, January 15, 1918.

This paper contains the results of experiments carried out a few years ago by Señor L. E. MARTÍNEZ at the Agricultural Station of Villa Hermosa, Tabasco, of which he was the director.

Gombo or "chimbombó", as it is called in Mexico, includes two species, the dwarf *Hibiscus abelmoschum* and the giant *H. esculentum*, which, in hot climates, reaches a height of nearly 10 feet.

This Malvaceae is very strong and adapts itself to the most varied climates (it only suffers from hard frosts) and to all soils. It does best, however, in sandy humus soils which have not long been cleared

of trees and in alluvial soils. In warm countries it can be sown throughout the year, in temperate countries in spring and summer. As the tegument of the seed is hard it is well, if possible, to irrigate before sowing, otherwise it is best to wait for the period following the first rains. If gombo is cultivated especially as a vegetable, i. e., for its green fruit, it should be sown in lines 6  $\frac{1}{2}$  feet apart with 3  $\frac{1}{4}$  feet between the plants; if grown for its fibre these distances should be reduced by half. The only cultivation needed is hoeing. The plant begins to bear fruit 2 months after sowing. If the fruit, especially the first, is cut as soon as it forms, the plant develops better and in 6 months grows to a height of 10 feet or more; it should then be cut and not left till it loses its fine texture and sheen. The stalks, cut and put up in bundles, are macerated for 8 days; if possible the water should be renewed and the bundles washed frequently; finally they are rinsed in clean or soapy water and laid out in the sun to dry and bleach.

An ordinary sized gombo plant yields from 50 to 100 gm. or more of clean fibre, corresponding to 11 to 16 cwt. per acre. Before macerating the stalks the capsules are collected; the seeds obtained (4 to 8 cwt. per acre) yield an edible oil and a cake which may be used either as a concentrated food or as a fertiliser. Roasted they are used as a substitute for coffee. The tender fruit is prepared in various ways; cut in slices and dried in the sun it keeps till winter. The wood of the stalk and the fibrous covering of the capsule are excellent material for paper-making. The leaves and tender parts of the plant, if ensilaged, form excellent fodder for cattle; dried naturally they may serve as a substitute for tobacco, for they resemble it in appearance and when burning have almost the same smell.

868 - Results of Growing Sweet Sorghum in Piedmont, Italy. — JACOMETTI, G., in *Cronaca agricola, Organo Ufficiale dell'Associazione Agraria Piemontese*, Year XXIII, No. 9, p. 44 + 3 Figs. Turin, May 16, 1918.

SUGAR CROPS

The author grew sweet sorghum at Villafranca Piemonte (province of Turin). On a plot 45  $\frac{1}{2}$  sq. yds. in size he obtained, as an average of several years, 220 lb. of stalks and 22 lb. of seed. The 220 lb. of stalks yielded from 90 to 120 lb. of juice, and from 99 lb. of juice were obtained from 15  $\frac{1}{2}$  to 17  $\frac{1}{2}$  lb. of sweet syrup. The author recommends the cultivation of this sorghum in Italy, especially for the preparation of the syrup for home use (simply by concentrating and removing the scum).

869 - Plants Suitable for Paper-Making in South Africa. — LEIGHTON J., in *The South African Journal of Science*, Vol. XIV, No. 6, pp. 287-289. Cape Town, January, 1918.

VARIOUS CROPS

South Africa can furnish large quantities of Tambookie grasses (*Andropogon* spp.) suitable for making paper pulp. Samples of such paper, prepared by BERTRAMS, Limited, of Edinburgh, were quite satisfactory. The commonest Tambookie grasses are *A. hirtus*, growing to a height of from 2 to 3 ft., and *A. Nardus*, growing to a height of 5 or 6 ft. The former species is common throughout South Africa, while the latter occurs in patches adjoining forests and in moist places.

*Cyperus textilis* and *C. hexangulare*, common near rivers and wet localities in South Africa, produce a very strong paper; 5 to 10 % of their pulp mixed with Tambookie grass pulp produces an extra strong paper.

Among other plants suitable for paper-making are : *Sansevieria thyrsiflora*, an underbush plant common in the eastern regions ; *Fleurya peduncularis*, a nettle common in moist places ; *Agave americana*, introduced all over the country ; maize cob husks and plantain fibre.

FRUIT  
GROWING

870 - **Investigations into the Autumn Growth of Fruit, in Italy.** — MANARES, ANGIO, in *Il Coltivatore*, Year LXIV, No. 9, pp. 180-183, and No. 12, pp. 246-248 + 1 Diagram. Casale Monferrato, 1918.

The experiments described were carried out by the author in an orchard at Imola planted in 1903 with pears (*Curato* and *Bergamotta Esperen* varieties) grafted on quince, with apples (*Reinette*, *Belle fleur jaune*, *Rosa romana*, *Garofana*, *Rosmarina* varieties), grafted on doucine and quinces (*Van Demon* and *Géante de Vranja* varieties) grafted on stock sprung from seed.

The author summarises the results of his investigations carried out to verify the studies of RIVIÈRE and BAILHACHE in France (1) and of WHITEHOUSE in the United States (2), according to whom winter pears, like apples, grow most during the period immediately preceding harvest.

1) The volume (and, naturally, the circumference as well) increases till a little after mid-October for winter pears, till after mid-November for late apples. Quinces are intermediate between the two, but resemble pears rather than apples. Consequently it would be well to bear these facts in mind when gathering these fruits unless other circumstances make an earlier harvest preferable.

2) The development curve of these fruits shows clearly that, contrary to the results obtained by the above mentioned workers in France and America, growth decreases as the season advances.

3) The specific weight of these fruits continually decreases during the last weeks before they fall.

4) The growth of the fruit depends on their more or less favourable situation and the number of fruits on the branch or on the plant.

871 - **The Common Honey Bee as an Agent in Plum Pollination.** — HENDRICKSON, A. H., in the *College of Agriculture, Agricultural Experiment Station, Berkeley, California*, *Bulletin* No. 291, pp. 215-236 + 13 Figs. Berkeley, January, 1918.

The results of these experiments, which are a continuation of those of the preceding year (3), may be summarised as follows : —

The average yield per tree of French (Agen) plums was increased by the use of bees in the orchard, but there was no increase in the yield of the Imperial variety. The percentage of setting was greatly reduced for both varieties when all pollen-carrying insects were kept away from the trees. The percentage of setting in a French plum tree enclosed in a tent of mosquito netting with wooden supports alone or with an Imperial tree and a colony of bees was higher than the orchard average for the variety. An Imperial

(1) G. RIVIÈRE and G. BAILHACHE, Etude sur l'accroissement du volume des fruits (*Journal de la Société nat. d'Horticulture de France*, December, 1917). — (2) W. E. WHITEHOUSE, A Study of Variation in Apples During the Growing Season (*Oregon Station Bull.* 134, 1916, 3-13) (*Auithor*). — (3) See R. JUNE, 1918, No. 649. (*Ed.*)

tree gave a good crop when alone in a tent with bees, but a slightly higher yield than the orchard average when enclosed with a French plum tree and bees. The French plum tree which had given a heavy crop in 1916 when enclosed in netting with bees, gave a very light crop in 1917 when left free. A plum tree which had given a small crop in 1916 when under a tent alone, gave, in 1917, a percentage of setting which was satisfactory although below the general orchard percentage. Both the Imperial trees which had given a small yield in 1916, gave heavy crops in 1917 under open orchard conditions. The percentage of setting of the French varieties was in inverse proportion to their distance from the Imperials.

The results of the two year's work led to the following conclusions: —

1) Both French and Imperial plum trees set better if hives are placed in the orchard during the flowering period, provided the trees are in normal healthy condition.

2) If there are no bees in the orchard the percentage of setting of these varieties may be low.

3) The French plum does not absolutely require to be interplanted with the Imperial, though such interplanting may prove beneficial to both varieties.

872 — **The Mulehng of Orange Groves in California and its Effects.** — See No. 840 of this *Review*.

873 — **The Chasselas × Berlandieri 41 B. Vine in Sicily.** — PAULSEN, F., in *Le Progrès agricole et viticole*, Year XXXV, No. 16, pp. 367-369. Montpellier, April 21, 1918.

VINE GROWING

For some years Sicilian vine-growers have re-constructed their vineyards with two stock only: — Aramon × Rupestris Ganzin No. 1 and, by preference, Rupestris du Lot. They should realise that other hybrids may be used many of which, especially those of Berlandieri, are superior to Rupestris du Lot under certain soil conditions.

One of these, little known and little used in Sicily, is Chasselas × Berlandieri 41 B, a hybrid created by MILLARDER which was successfully used in reconstituting the Charentes vineyard in France, in a district where there is a predominance of tertiary limestones, which are most apt to cause chlorosis. Under these very difficult conditions of growth the most reliable and satisfactory reconstitution of these vineyards, planted with Folleblanche, which give the best cognac of world-wide fame, was obtained with 41 B.

Chasselas × Berlandieri was not readily used in the foremost Sicilian experimental yards because there were numerous phylloxera growths on its roots and its resistance in the Sicilian climate was doubted. Time, however, has shown that in spite of its susceptibility to phylloxera it is sufficiently resistant. The author has never seen it die either in stock plantations or even in the oldest experiment fields. He considers it a stock which might be advantageously used for reconstituting Sicilian vineyards if it is judiciously employed and adapted particularly to the conditions it prefers. It is especially suited to very calcareous soils with marly sub-soil. In the Sicilian climate it resists well in soils containing 80 to 90 %

of lime. The author has also observed it in very good condition in calcareous loam and even in sandy loams where clay predominates without any trace of lime. It should not be used in arid, poor soils and those retaining an excess of water which are cold and wet in spring. The soils which suit it best are those which warm rapidly but have a cool sub-soil.

It did well in the Marsala experiment vineyards in ground with rich calcareous marly sub-soil, but failed in dry soil the sub-soil of which consisted of arid calcareous tufa. Excellent results were obtained with it in the experiment field of S. Giuseppe Lata, on the estate of Prince CAMPOREALE in calcareous loam, and it also does well in the stock yard of the Royal Nursery of American Vines in the Luparello district, in rather heavy sandy loam.

‡ Chasselas × Berlandieri 41 B is very satisfactory for budding and has a good affinity for most of the local vines. It is one of the plants most resistant to bramble-leaf disease.

874 - **The Influence of the Stock and Other Factors on the Quality of the Wine: Experiments Carried Out in Sicily.** — PAULSEN, F. and MAGGIONI, N., pp. 47 + 3 Tables + 4 Diagrams. Palermo, 1915. Abstract in *Le Progrès agricole et viticole*, Year XXXIV, Nos. 42 and 43 Montpellier, 1917.

The results of comparative experiments carried out at Marsala from 1907 to 1912 are given: —

1) The quality of the wine depends in part only on the scion and the stock and much more on other conditions which are quite independent of the grafted vine — good or bad seasons, soil conditions, date of harvest, condition and quantity of produce, etc. It is a character, therefore, due partly to internal (intrinsic) and partly to external (extrinsic) conditions or due to the environment in and conditions under which the vine is cultivated.

2) A high yield is not always proof of an inferior quality produce; on the contrary there is sometimes no connection between quality and quantity in the case of very productive stock planted in fresh and fertile soil.

3) The differences in the alcohol degree of wines due to variations in weather condition from one year to another, are very marked and range from a minimum of 1.3° to a maximum of 3.4°, according to the quality of the stock, but are much less in dry years (1.5°) than in wet years (2.6°).

4) The differences in the alcohol degree, due to variations in soil are less marked than the preceding ones, and range from a minimum of 0.3° to a maximum of 1.3°, according to the stock. The limits within which these variations occur are the same in dry as in moist soils.

5) Differences due to the nature of the stock are still less marked and do not exceed an average of  $\frac{8}{10}$  of a degree.

6) Such variations in the alcohol degree of one stock or another may be obscured by other components of the wine, so that they are hard to detect by the taste.

7) An average of four years of experiment shows that the various stock may be classed in the following decreasing order with regard to the

quality of the produce :— 420 A, Aramon  $\times$  Rupestris 1202 and 17-37 (both of the same degree) and Rupestris du Lot.

8) The stocks which gave produce of the most constant quality and quantity were 17-37 and 420 A. As a rule these are vines of average yield and vigour, earlier or less sensitive to seasonal influences and various other factors. Aramon  $\times$  Rupestris, Rupestris du Lot, and 1202 gave irregular produce, though with a high alcohol degree, especially the first two.

9) The differences from one year to another, and even in the same year, between the yield of Grillo and that of the native vines grown in the Marsala district, are very marked, even when the plants are grafted on the same stock.

10) The quality of the produce, within certain limits at least, is in inverse ratio to the drought-resistance of the stock, their vigour and the delay in the ripening of the grapes in moist soils or wet years, and vice versa. It improves in proportion to the lateness of the harvest, and is in accordance with the facility with which the vines adapt themselves to very calcareous soil.

What is the practical importance of the variations produced by the scion on the different stocks, and how can they be combined with those produced by environment and other known causes so as to produce the best results? First of all it is possible to obtain with grafted vines wine of excellent quality even surpassing that of the wines obtained in the past; the same applies to yield.

There are many causes accounting for differences in the quality of the produce — larger productive capacity of native vines grafted on American ones, earlier development and riper grapes, more careful selection of the graft cuttings and the native varieties, simultaneous and concordant action of the variations caused by the scion with that of the other factors, or of the compensation between the effects of the scion and those of other causes acting in the opposite sense.

Grafting on American vines is an efficient method of regulating the vegetation and yield of the vines. All depends on a choice of a scion which, without prejudice to the yield and life of the plant, develops best the desired qualities.

On the other hand, however, experience has shown that the yield of no stock is positive, but only relative, according to the year, nature of the soil, etc. Therefore, whereas on one hand preference should be given to certain stock which give a high yield of the best quality fruit, it would on the other hand be well to be able to dispose of several stock to take advantage of the character of each, according to the year. The system of plantations of mixed stock and that of cultivating too many different varieties of native vines which, though they produce well are not to be recommended for quality, is to be condemned. At Marsala such varieties should be limited to Grillo and Cataratto; only in special cases should Catanese and Damaschino be used.

Many Sicilian vine-growers have been too easily led to favour Aramon  $\times$  Rupestris, a stock which certainly has undeniable advantages, amongst

which is the very important one of giving very high yields, but which for various reasons should not form the sole base of reconstitution or the risk of making a serious mistake is incurred. In reconstitution more importance should be given to the Berlandieri hybrids, hitherto little used as compared with Aramon  $\times$  Rupestris, but for which a great future is in store by reason of their characteristic qualities, and, above all, the excellent and regular yield obtained from native vines with them. Of these may be specially recommended 420 A, 17-37, 34 E. M and also 41 B, to which may perhaps be added in time other good hybrids obtained in Sicily by PAULSEN, RUGGERI, and GRIMALDI.

Another stock which has given excellent results in the Marsala district is Mourvèdre  $\times$  Rupestris 1 202, especially when grafted with Grillo, not only by reason of its luxuriant vegetation, but also because of the high alcohol degree and fineness of the wines made from it.

The system of using a single stock, even in the case of the quality, has been, and always will be, a great mistake, as great, or even greater, than that of mixing many different vines.

From a point of view of wine-making, the authors found that at Marsala, beside the typical liqueur, it would be possible to produce an excellent, almost colourless white wine, alcoholic, but of an acid and slightly tart flavour. This is obtained especially from Grillo grafted on Aramon  $\times$  Rupestris or other late-ripening stock. Such wine would be valuable in the export trade. To make it, apart from the use of the varieties mentioned above, it is only necessary to subject the wine as little as possible to the action of air and heat, which are the two essential factors in the manufacture of Marsala. These conditions may easily be obtained by bottling the new wine when a few months old, after decanting it with a pump to avoid contact with the air, closing the bottles hermetically and keeping them in a coldish cellar. If this is not done, in time the wine changes colour and flavour, acquiring the characters of Marsala without any special process.

## LIVE STOCK AND BREEDING.

### HYGIENE

875 - Observations on Abortion Disease, in the United States. — SCHROEDER, E. C. and CORRON, W. E. (Bethesda, Md., Experiment Station, Bureau of Animal Industry, U. S. Department of Agriculture), in *The Journal of Agricultural Research*, Vol. XI, No. 1, pp. 9-16. Washington, April 2, 1917.

As far as the writers have been able to learn in their wide experience with the disease, the abortion bacillus is an obligatory parasite. It may live and retain its virulence for a long time in infected material expelled from the uteri of infected cows, but no data are available to support the belief that it can maintain itself or multiply under natural conditions as a saprophyte. Hence, the chronic persistence of the microparasite in the bodies of infected cows is probably the most important among the causes responsible for the propagation, the perpetuation, and wide prevalence of the disease.



The favourite habitat of the abortion bacillus in the bodies of cows is the udder, and the udder is seemingly its only habitat in the bodies of non-pregnant cows. One cow under test for 7 years gave abortion bacilli continuously in her milk. The bacillus was never found in the milk from a cow unless both her milk and her blood serum possessed agglutinating properties for it, but repeatedly cows were found which reacted, but the bacilli were not found in the milk. By experimental inoculation of a cow, the authors were able to demonstrate that the bacilli passed from the udder to the uterus. They believe that the abortion bacilli in ingested milk do not penetrate deeply or abundantly into a calf's body.

**876 - Contribution to the Study of the Mortality of Calves: Coli-bacillary Broncho-pneumonia.** — **COMINOTTI, L.** (Stazione sperimentale per le Malattie infettive del bestiame in Milano), in *La Clinica veterinaria*, Year LXI, No. 7, pp. 167-173. Milan, April 15, 1918.

Under the general term of mortality ("moria") of calves various morbid forms are included that are classified differently by various authors. The predominating form is, however, coli-bacillosis, though it appears under different clinical, anatomical and pathological aspects. The appended observations were made by the author during protracted researches.

Coli-bacillosis of calves may develop under the clinical, anatomical and pathological form of an acute broncho-pneumonia.

The articular form of coli-bacillosis may, in certain cases, represent a complication of the septicæmic form of uncertain course, owing to a secondary infection by common organisms.

*Bacterium coli* may cause nodular formations in the liver of calves, as was observed by LANGER for a bacillus of the sub-group *Enteritidis Paratifo* B., and by VALLÉE in pseudo-tuberculosis of calves.

**877 - Method for Freeing Pigs from Lice.** — *Chacaras e Quintaes*, Vol. XVII, No. 1, pp. 13-15 + 2 Figs. São Paulo, January 15, 1918.

The following mixture is recommended for destroying lice and all ectoparasites of pigs: oil (any quality) 1.75 pints; paraffin 0.88 pints; essence of turpentine 0.44 pints; about 2 gallons of hot water. This preparation should be applied twice at an interval of ten days. When breeding on a large scale baths should be constructed, or it may be applied by the pigs themselves by means of special apparatus (one is sufficient for 250 animals) consisting of a support firmly fixed into the ground against which the animals rub themselves, surmounted by a vessel containing the mixture and fitted with valves which open when the support is slightly raised by the pigs rubbing themselves. The sties must also be disinfected.

**878 - On the Hereditary Transmission of Rabies (1)** — **I. LANFRANCHI, A.** and **LENZI, F.**, Transmission of the Virus of Rabies from Mother to Fœtus, *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 8, pp. 396-398. Paris, April 28, 1918. — **II. REMLINGER, P.**, On the Possibility of Conceptional Rabies. *Ibid.*, pp. 418-419.

**I.** — The authors record a new case of the transmission of the virus of rabies from mother to fœtus, observed in a bitch which had lived for some

(1) *Sec R*, April 1916, No. 413. (Ed.)

time in contact with a mad dog, 6 months before conception. At the post-mortem, NEGRI corpuscles were found in the region of the cornu of the brain; the biological test (injection of dilute marrow in rabbits) gave positive results. This proves that the virus of rabies in the blood-stream can pass the placental filter and infect the fœtus.

II. — The possibility of conceptional rabies presupposes the presence of the virus of rabies in both the sperm and ovule. For this reason the author sought for it in the contents of the seminal vesicles, in the testicles, and in the ovaries of rabid guinea-pigs. The results were always negative. The author concludes that conceptional rabies does not exist and that all the cases of inherited rabies are to be traced back to placental infection.

879 — **Studies on Sarcoma in Chickens.** — JABLONS, B., in *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, No. 7, pp. 327-328 Paris, April 13, 1918.

The author first studies the spread of sarcoma virus through the chicken's organism. The virus enters the blood. The serum of an infected chicken (prepared either by coagulation or by centrifugalisation of freshly drawn blood) injected into a new chicken in amounts of 1 cc. reproduces sarcoma with the characteristic fusiform cells. If the chicken shows general sarcomatosis of the peritoneum the virus passes into the ascitic liquid.

The increase in the virulence of the serum of infected chickens kept 10 days in the incubator at 37° C. was then studied. Under these conditions the serum was four times as virulent and reproduced lesions in a fresh chicken when injected in quantities of 0.25 cc. The author does not believe this to be a case of true increase in virulence, but rather of an increased number of micro-organisms which have multiplied at the temperature of the incubation. The passage of the virus through the chicken increases its virulence and shortens the incubation period of the disease (after the 7th. passage of the virus the lesions developed in 13 days instead of 27 to 42).

The fleshy tumour dried and kept in the ice-chest, retained its virulence for twelve months, but lost it at the end of the thirteenth.

880 — **Mallophaga Ectoparasitic on Birds, in Formosa.** — UCHIDA, SEINOSUKE, in the *Journal of the College of Agriculture, Imperial University of Tokyo*, Vol. III, N° 4, pp. 171-188 + 1 Plate. Tokio, June 15, 1917.

The author describes 21 species (17 being new to science) belonging to 8 genera of Mallophaga ectoparasitic on birds, killed in Formosa. These are: — *Laemobothrium loomisii* on *Nannocnus cinnamomca*; *Lipeurus variabilis* and *Nirmus vittatus* on *Accipiter virgatus*; *Colpocephalum osborni* on *Milvus ater govinda*; *Colpocephalum pachyaster* on *Pandion haliaetus*; *Nirmus ovatus* n. sp., *Lipeurus variabilis*, *L. intermedius* var. *major* n. var., *Goniodes intermedius*, *Menopon productum*, *M. mikadokiji* n. sp., on *Calophasis mikado*; *Lipeurus formosanus* n. sp., *L. rubrifasciatus*, *Gonicotes microcephalus* n. sp., *Menopon pallescens*, *M. longipectum* n. sp., on *Arboricola crudigularis*; *Colpocephalum umbrinum* var. *trilobatum* on *Tringa subminuta*; *Nirmus incanis* on *Tringa ruficollis*; *Lipeurus baculus* on

*Turtur chinensis*; *Lipeurus baculus* and *Goniocotes kurodai* n. sp. on *Spenocercus sororius*; *Docophorus communis* on *Pericrocotus griseigularis*; *Lipeurus baculus* and *Goniocotes kurodai* on *Grancalus rex-pineti*; *Menopon urocissae* n. sp. on *Urocissa cerula*.

FEEDS  
AND FEEDING

881 - **A Study of the Dietary Essential, Water-Soluble B, in Relation to its Solubility and Stability towards Reagents.** — MCCOLLUM, E. V. and SIMMONDS, N. (Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXIII, No. 1, pp. 55-89, 11 Diagr., Bibliography of 13 Publications. Baltimore, Md., January, 1918.

In conducting the work reported in this paper the authors fed rats on a diet of purified food substances together with 5 per cent of butter fat to supply an abundance of the fat-soluble A. This diet was complete except that it was free from the water-soluble B. The rats were confined to this food mixture until they either had become stationary in weight or were declining. By the 5th week nearly all were either stationary in weight or were failing and they almost invariably showed signs of paralysis at about this time. When the rats were thus prepared, the material to be tested for the water-soluble B was put into the diet. The animals then either continued to decline or responded with growth. This method served to show within 2 weeks whether the substance B was contained in significant amount in the preparation under investigation.

In the experimental part of this paper it is shown that the water-soluble B is not extracted directly from beans, wheat germ, or pig kidney by ether, benzene, or acetone, but it is readily extracted in great part by alcohol. After being removed by alcohol it is shown to be soluble in benzene, but very slightly soluble in acetone. The probability that there should be two or more physiologically indispensable substances in what is termed water-soluble B, both or all of which should show the same solubility relations with three solvents, is relatively small and lends support to the authors' view that the substance which protects animals against polyneuritis is the only essential complex in the extract described. In other words, the data support the view that there are no specific substances present in these extracts which protect against such diseases as scurvy, rickets, pellagra, sprue, etc., and tend to confirm the contention that the latter are not due to specific starvation as in the case with beri-beri and xerophthalmia (1).

882 - **A Comparative Study of the Behaviour of Purified Proteins towards Proteolytic Enzymes.** — FRANKEL, E. M. (Sheffield Laboratory of Physiological Chemistry, Yale University, New Haven), in *The Journal of Biological Chemistry*, Vol. XXVI, No. 1, pp. 31-59 + 9 Tables + 4 Diagrams. + Bibliography of 33 Publications. Baltimore, Md., August, 1916.

After having rapidly considered the methods — physico-chemical, optical, colorimetric, purely chemical — used up to the present for studying the processes of digestion, the author describes his experiments for the pur-

(1) See R. January 1918, No. 2 (Ed.)

pose of studying the digestibility of the white of egg by means of pepsin, trypsin and erepsin; the results obtained by the author are given below.

It has been demonstrated that pepsin is the effective agent in pepsin-hydrochloric acid digestion, since hydrochloric acid alone in the concentrations ordinarily employed has very little proteolytic effect. As a result of a series of experiments the conclusion seems justified that comparable results in proteolysis studies are to be obtained only when the substrates are in solution; otherwise deviations of 10 to 15 per cent may be encountered in duplicate experiments. An examination of the digestion of thirteen proteins shows that there is a parallelism in the cleavage curves of all the proteins, if the cleavage is calculated as the ratio of the amino-nitrogen liberated at any one time to that obtained on total hydrolysis of the protein with strong acid.

Pepsin-hydrochloric acid can liberate about 20 per cent. of the total amino-nitrogen of a protein in less than 100 hours. Trypsin acting upon proteins partially digested with pepsin effects a cleavage of about 70 per cent. The action of trypsin upon native proteins can cause a cleavage of about 50 per cent of the peptide linkages. Further addition of trypsin may cause further disintegration of the protein.

Erepsin following the action of pepsin is a very effective agent in causing the disruption of the protein molecule. In two series of experiments cleavage of about 85 per cent of the protein could be demonstrated. The successive action of pepsin, trypsin, and erepsin liberates about 85 to 90 per cent of the total amino-nitrogen of the protein studied.

**883 - Study of the Proteins of Certain Insects with Reference to their Value as Food for Poultry.** — MCHARGUE, J. S. (Laboratory of Chemical Research, Kentucky Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. X, No. 12, pp. 633-637 + Bibliography of 9 Publications. Washington, September 17, 1917.

THOMAS was the first to demonstrate experimentally that animal proteins are much superior to vegetable proteins in maintaining the nitrogen equilibrium of the animal body. He showed that the minimum daily quantities necessary to protect body protein from loss were: — meat protein 30 gm., milk protein 31 gm., rice protein 34 gm., potato protein 38 gm., bean protein 54 gm., bread protein 76 gm., maize protein 102 gm.

The author determined the percentage of growth-promoting acids in the proteins of two common insects — the June bug (*Lachnosterna* sp.) and the grasshopper (*Melanoplus* spp.) as compared with the percentage of proteins in roast beef and turkey white meat. He found the following values for each of the two insects respectively: — Ammoniacal nitrogen, 8.96, 9.14; melanin, 6.78, 3.42; arginin, 11.53, 14.98; histidin, 6.57, 5.62; cystin, 0.35, 0.23; lysin, 8.02, 8.04; amino nitrogen (in filtrate from bases), 50.80, 52.87; non-amino nitrogen (in filtrate from bases), 5.84, 4.32. There is, on the whole, a great similarity in the proteins from such different sources. There is a close agreement in the lysin and arginin contents of the two insects studied and beef and turkey meat. In the beef and turkey the percentage of cystin is almost double and that of histidin two to three times that of the insects.

The protein content of grasshoppers, killed by potassium cyanide, dried at 100° C., ground in a mortar, and kept in a closed bottle for seven months, underwent no alteration, thus showing that the dried material can be kept indefinitely. An analysis of the dried matter gave the following percentages: — Protein, 75.28; ether extract, 7.21; crude ash, 5.61. Dried grasshoppers contain more protein than commercial meat meal and would probably be an excellent substitute for it in poultry feeding.

884 — **Utilization of Farm Wastes in Feeding Live Stock in U. S. A.** — RAY, S. H., <sup>111</sup>  
*U. S. Department of Agriculture, Farmers' Bulletin 873*, pp 1-12. Washington, D. C., April, 1917.

More than  $\frac{1}{3}$  of the total production of cereal straw in the United States is not used to advantage, and  $\frac{1}{2}$  of this amount is a total loss, the value of which is estimated at more than \$ 100 000 000. In a three years' study of corn-belt cattle the Office of Farm Management found that the breeding herds maintained most largely on oat or wheat straw, maize stover, etc. (with a very small quantity of concentrated feed such as cottonseed meal, maize, etc.), returned the largest profits.

Of all the uses to which straw and maize stover may be put, the only really economical ones are as food or bedding, and, of these two, their use as food is by far the most satisfactory.

To prepare stover for feeding purposes it should be cut and shocked; it may be chopped or shredded if cheap power and labour are available, but otherwise the cost is disproportionate to the advantages gained. Waste is greatly decreased by shredding or cutting dry corn stover and putting it in the silo with water. Of all the methods, ensiling is the most economical. Straw and stover should be used in the fattening rations of all animals except hogs, and should compose the larger part of all winter or maintenance rations for cattle, sheep and horses. Breeding herds of beef cattle, and dairy cows do well on rations composed largely of these products; the same applies to ewes if some grain is added. Horses doing very light work or none at all need little grain if they have a liberal allowance of clean straw or stover. Rye straw should not be fed to dairy cattle, because of its toughness and the danger from ergot, and buckwheat straw, on account of its low food value, should only be given when other roughages are not available. When barley straw is used the mouths of the cattle should be examined occasionally as the dry, stiff beards are apt to set up irritation.

The following rations are proposed for various classes of animals: —

**BEEF CATTLE. Winter rations. —**

- 1) Straw, 10 lb.; silage, 20 lb.; cottonseed or linseed meal, 1 lb.
- 2) Straw, 20 lb.; cottonseed or oil cake, 2 lb.
- 3) Straw, 10 lb.; maize fodder, 10 lb.; cottonseed or linseed meal, 1 lb.
- 4) Stover, 35 lb.; cottonseed or linseed oil meal, 1 lb.

**Fattening rations (for 1 000 lb. steers). —**

- 1) Straw, 5 lb.; silage, 18 lb.; maize, 12 lb.
- 2) Straw, 8 lb.; leguminous hay, 6 lb.; cottonseed or linseed cake, 5 lb.
- 3) Stover, 10 lb.; silage, 15 lb.; maize, 12 lb.
- 4) Straw, 5 lb.; stover, 15 lb.; maize, 6 lb.; cottonseed meal, 3 lbs.

DAIRY CATTLE. *Ration for dry cows, bulls and heifers.* —

Maize stover and straw, unlimited; clover hay, 10 lb.; maize silage, 20 lb.; cottonseed meal, 1 lb.; maize- and-cob meal, 2 lb.

*Ration for cows about to calve.* —

Maize stover, 5 lb.; clover hay, 12 lb.; maize silage, 25 lb.; wheat bran, 3 lb.

*Ration for cow giving 16 lb. of 4 % milk.* —

Maize stover and straw, unlimited; clover hay, 12 lb.; maize silage, 20 lb.; cottonseed meal, 2 lb.; maize-and-cob meal, 3 lb.

*Ration for cow giving from 20 to 25 lb. of 4 % milk.* —

Maize stover and straw, unlimited; clover hay; 12 lb.; maize silage, 25 lb.; cottonseed meal, 2 lb.; maize and cob meal, 3 lb.; gluten feed, 3 lb.

SHEEP. (Supplementary rations with a little grain). —

1) Maize stover, 2 lb. (amount eaten, not amount fed); leguminous hay, 2 lb.

2) Oat straw, 2 lb.; leguminous hay, 2 lb.;

3) Oat straw or maize stover, 1 lb.; silage, 1 1/2 lb.; leguminous hay, 2 lb.

HORSES. *Maintenance rations for 1000 lb. idle horse.* —

1) Maize stover, 9 lb.; alfalfa hay, 3 lb.; maize on cob, 5 lb.

2) Oat straw, 8 lb.; alfalfa, 8 lb.; cane molasses, 3 lb.

*Daily ration for 1000 lb. horse at light work* —

Maize stover, 5 lb.; Bermuda hay, 5 lb.; cottonseed meal, 1/2 lb.; cowpeas, 2 lb.; shelled maize, 5 lb.

*Daily ration for 1000 lb. horse at heavy work.* —

Maize fodder, 4 lb.; alfalfa, 12 lb.; ground soy beans, 1 lb.; shelled maize, 12 lb.

*Daily rations for 1250 lb. idle horse.* —

1) Maize stover, 11 lb.; alfalfa, 5 lb.; ear maize, 4 lb.

2) Oat straw, 10 lb.; pea hay, 4 lb.; common beets (or other roots or silage), 4 lb.; oats, 4 lb.

*Daily ration for 1250 lb. horse at light work.* —

Barley straw, 5 lb.; alfalfa hay, 6 lb.; rolled barley, 8 lb.

*Daily ration for 1500 lb. idle horse.* —

Maize fodder (with ears), 18 lb.; alfalfa, 5 lb.

## BREEDING

885 — **Observations on the Inheritance of Colour and Distribution of Sex in Certain Animals at the Government Cattle Farm, Hissar, Punjab, India.** — BRANFORD, R. (Superintendent, Government Cattle Farm, Hissar), in *The Agricultural Journal of India*, Vol. XII, Pt. IV, pp. 573-578. Calcutta, October, 1917.

**INHERITANCE OF COLOUR IN MULES.** — Several years of breeding gave the following results:

Number and colour of mares	Colour of donkey	Number and colour of males
12 } bay or brown	black or dark brown	111 bay or brown
12 } bay or brown	mouse-colour	6 bay or brown
13 chestnut	black or dark brown	41 bay or brown
1 chestnut	mouse-colour	1 bay
13 roans	black or dark brown	18 bay or brown; 2 dun
14 grey	black or dark brown	18 bay or brown; 6 grey; 2 dun; 1 mouse-colour.
6 grey	mouse-colour	6 bay or brown.
4 dun	black or dark brown	4 bay or brown.
1 dun	mouse-colour	1 bay
2 sk. white	black or dark brown	3 bay or brown.

It is seen, therefore, that by crossing brown or mouse-coloured donkeys with brown or chestnut mares bay or brown mules, are sure to be obtained. The army prefers dark mules. Chestnut colour, which is recessive in mares and does not exist in donkeys, is rarely found in mules though it does occur. Of 1200 mules entered in the register of the Government Cattle Farm, Hissar, 8 were chestnut. Similarly, by crossing dun, roan or skewbald mares with dark donkeys, bay or brown mules are nearly always obtained. Uniform colour in donkeys seems dominant to white spots on the head and legs in mares, as mules practically never have these spots.

From two chestnut mares and one skewbald mare served by a zebra were obtained three hybrids with coats having a light bay, rather yellow ground, and the distinctive black markings of the zebra.

#### INHERITANCE OF COLOUR AND DISTRIBUTION OF SEX IN DONKEYS.

— The following data are compiled from the Government Cattle Farm, Hissar register. It is pointed out that mistakes may easily be made in describing a donkey as grey; this largely discounts the value of the figures:—

Number and colour of mares	Colour of stallion	Number and colour of foals
16 brown	black or dark brown	82 brown; 8 grey; 3 mouse-colour.
4 brown	mouse-colour	2 mouse-colour; 1 grey; 1 brown.
9 mouse-colour	black or dark brown	14 mouse-colour; 17 brown; 6 grey;
1 mouse-colour	mouse-colour	1 mouse-colour.
4 white	black or dark brown	12 grey; 1 brown; 6 mouse-colour
13 grey	black or dark brown	26 brown; 5 mouse-colour, 27 grey.

It seems that, as a rule, black or dark brown donkeys transmit this colour to their progeny. The striking tendency of the coats of grey horses and mules to turn lighter with age is not observed in donkeys, whose coats tend to become darker. During the last 10 years 530 donkeys, of which 272 were colts and 258 fillies, were born at the Government Cattle Farm, Hissar.

**INHERITANCE OF COLOUR IN SHEEP.** — Seven lambs of five black ewes served by an Australian white Merino ram were all black.

**INHERITANCE OF COLOUR AND DISTRIBUTION OF SEX IN CATTLE.** — Red Sihwal cows bred to a red bull of the same race gave 48 red calves and 2 grey ones. Sihwal cattle may be of various colours, but red is usually preferred. During the last 10 years there were born on the Hissar Government Farm 7642 calves, of which 3927 were male and 3715 female.

886 — **Oatless Rations for Draught Horses.** — DECHAMBRE, M. P., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 15, pp. 480-497. Paris, May 1, 1918.

HORSES

This is a paper presented to the "Académie d'Agriculture", indicating the substitutes which may be advantageously used at the present time in the feeding of draught horses, and giving formulae for mixing them so as to obtain a food value equal to that of oats, as well as complementary rations containing rough and concentrated foodstuffs.

The food value of a substitute is based on the amount required to replace 1 lb. of oats. The proportion, however, is not constantly exact; to

obtain a good ration of substitutes the foodstuffs must be judiciously mixed in order to obtain the essential result; *i. e.*, to give the animal amounts of food equal to its original ration without modifying perceptibly the volume and bulk of the ration or the equilibrium established by determining its nutritive ratios.

*Equivalency in oats of the principal substitutes* (weight in lbs. equal to 1 lb. of oats):

Groundnut cake . . . . .	0.745	Molasses straw (25 % saccharose) . .	1
Locust bean . . . . .	1	Palm kernel cake . . . . .	0.850
Copra cake . . . . .	0.800	Paddy . . . . .	1
Dried brewer's grains . . . . .	1.100	Sesame cake . . . . .	0.760
Barley germ . . . . .	0.900	Soya cake . . . . .	0.725
Cottonseed cake . . . . .	0.800	Soya meal . . . . .	0.750
Nut cake . . . . .	0.750		

*Formulae for mixing concentrated foods capable of replacing oats* (in lbs.).

1) Groundnut cake 1, cottonseed cake 0.500, barley germ 1, molasses straw 1.500.

2) Palm kernel cake 1, soya cake 0.500, bran 1.

3) Dried brewer's grains 1.500, rice residue 0.750, groundnut cake 0.500, copra cake 0.500.

4) Groundnut cake 2, bran 2, molasses straw 2.

5) Rice residue 2, groundnut cake 0.400, meat meal 0.150.

One pound of each of these mixtures will replace 1 lb. of oats; the final ration should be completed with hay and straw.

The following simpler mixtures are intended for partial substitution by available materials; each has the same food and energy value as 1 lb. of oats:

1) Equal weights of dried brewer's grains, rice residue, wheat bran, cottonseed or copra cake.

2) Equal weights of wheat bran, dried brewer's grain, groundnut meal.

3) Equal weights of sorghum or barley bran, dried brewer's grains, soya meal.

4) Wheat bran 0.900 lb., rice residue 0.600 lb.,

5) Rice bran 0.750, groundnut cake 0.150,

6) Barley roots 0.700, bran 0.400; mixture recommended for the preparation of mash.

These formulae may be varied in numerous ways. Chopping hay and straw makes possible other combinations of which the following two are samples: —

1) Groundnut cake 15 lb., cottonseed cake 5, bran 20, molasses 20, chopped straw 25, chopped hay 20; 1.1 lb. of this mixture equal 1 lb. of oats.

2) Cake (groundnut, sesame) 1 lb., soya meal 5, cottonseed cake 2, bran 18, molasses 20, chopped straw 25, hay 20; 0.98 lb. equal 1 lb. of oats.

Other foodstuffs — sorghum and buckwheat brans (which contain four times more cellulose than ordinary bran), sainfoin seed unsuitable for germination (food value similar to that of oats; should be used in small



quantities, in the natural state and mixed with oats or after soaking), beet seed also unsuitable for sowing (value = about  $\frac{2}{3}$  that of wheat bran.)

*Aqueous foodstuffs.* — Tubers and roots may be used in feeding horses to a larger extent than is customary, thus allowing a reduction in the quantity of oats. The amount to be substituted cannot be calculated with as much precision as for the preceding foods because of the difference in chemical composition and especially in the volume and water content of this produce.

*Carrots.* — 1 lb. of oats, 1 lb. of hay, 1 lb. of straw may be replaced by 6 lb., 3 lb., and 2 lb. of carrots respectively. The usual carrot ration is 12 lb. for a horse of the average weight of 1 000 lb.

*Parsnip.* — Preferred to carrot in Brittany; same proportion for substitution.

*Beet.* — As much as 22 to 26 lb. may safely be given to horses used for field work

*Jerusalem artichoke.* — A ration of 22 to 26 lb. may be safely fed; 3.5 to 4 lb. equal 6 lb. of carrots. A heavy draught horse (to which this foodstuff is better suited than to a carriage horse) can consume 13.2 lb. of Jerusalem artichoke, thereby replacing 3.3 lb. of oats or similar produce.

*Boiled potatoes.* — An amount equal to 0.9 lb. of dry matter is equal to 1 lb. of oats; thus, 3.60 lb. of average quality potatoes containing 25 % of dry matter can replace 1 lb. of oats. The ordinary ration is 11 lb. as a substitute for 2.97 lb. of oats.

All these substitutes should be worked on to gradually, beginning with small quantities; this is essential to avoid refusal to eat them and consequent waste.

Horses may be profitably put to grass and fed on alfalfa and green clover to economise maintenance expenses, but they must be put on oats again as soon as they re-start heavy work. The amount of green fodder which can be fed daily to a horse of 1 000 to 1 300 lb. without danger of digestive trouble, varies from 88 to 110 lb. according to the nature of the soil and the forage.

887— **Winter Steer Feeding Experiments in Indiana, U. S. A.** (1). — SKINNER, J. H. and KING, F. G., in *Purdue University Agricultural Experiment Station Bulletin* No. 206, Vol. XX, pp. 1-28. Lafayette, Indiana, September, 1917.

CATTLE

The ration feeding trials reported in this bulletin were conducted under exceptional economic conditions. The object of the trial was to obtain additional information on the comparative value of leguminous hay alone and in combination with maize silage as roughage for fattening cattle, to test the comparative value of clover hay and alfalfa hay as roughage for full-fed cattle, and to test the value of different rations with a limited feed of maize with maize silage as compared with a full feed of maize for finishing steers.

*Plan of experiments.* — Seventy medium feeding cattle were secured

(1) For similar experiments conducted under normal conditions see also R. June 1918, No. 668. (Ed.)

and divided into seven lots of ten steers each, as nearly alike as possible in size, condition, quality, thrift and breeding.

Each lot of cattle was placed in similar surroundings and fed for 140 days. The only differences between lots were in the rations fed which were as follows:—

*Lot 1.* No maize during the first month and a gradually increasing amount of shelled maize for the remainder of the period, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, maize silage, clover hay throughout entire period.

*Lot 2.* Shelled maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, clover hay.

*Lot 3.* Shelled maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, alfalfa hay.

*Lot 4.* Shelled maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, maize silage, clover hay.

*Lot 5.* No maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, maize silage, clover hay.

*Lot 6.* One-half feed maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, maize silage, clover hay.

*Lot 7.* Shelled maize, cottonseed meal 2.5 lb. daily per 1 000 lb. live weight, maize silage, alfalfa hay.

The prices of feeds used in presenting financial results are based on the actual market prices at the time the experiment was in progress. The average price of maize in La Fayette was as follows:—first month 88.3 *cents*, second month 93.9 *cents*, third month \$ 1.007, fourth month \$ 1.138, fifth month \$ 1.431 per bushel, cottonseed meal \$ 45.00 per ton, clover hay and alfalfa hay \$ 12.00 per ton, maize silage \$ 6.00 per ton. All financial statements are based on the above mentioned prices of feeds.

Each lot of cattle also contained ten hogs. They were of good quality and averaged approximately 105 lb. per head at the time the experiment started. All lots of hogs received maize in addition to droppings from the cattle. Table I shows a summary of the feeding operations and their results as relating to the 7 lots, comparing:—in lots 2, 4, 3, 7 (Part I) maize silage and leguminous hay vs. leguminous hay as roughage; in lots 4, 1, 6, 5 (Part II), a limited feed of maize with a full feed of maize; in lots 2, 3, 4, 7 (Part III); clover vs. alfalfa hay as roughage.

In the determination of costs no charge was made for straw used for bedding nor for labour of feeding; neither is any credit given for any manure produced by the cattle, it being considered that this by-product will pay for the labour of feeding and the straw used for bedding.

The principal results of these experiments may be summarized, as follows:—

*Part I.* (Maize silage and leguminous hay vs. leguminous hay as roughage for fattening steers; Lots 2, 4, 3 and 7).

The addition of 33.88 lb. of maize silage to a ration of shelled maize, cottonseed meal and clover hay, decreased the daily maize consumption 2.79 lb. per head and the daily hay consumption 11.46 lb. per steer.

## Summary of Experiments.

Part I, II, III.

Ration	Lot 1 Shelled maize (1), cottonseed meal, maize silage, clover hay	Lot 2 Shelled maize, cottonseed meal, clover hay	Lot 3 (2) Shelled maize, cottonseed meal, alfalfa hay	Lot 4 Shelled maize, cottonseed meal, maize silage, clover hay	Lot 5 No maize, cottonseed meal, maize silage, clover hay	Lot 6 One-half feed maize, cottonseed meal, maize silage, clover hay	Lot 7 Shelled maize, cottonseed meal, maize silage, alfalfa hay
Initial value per 100 lb. . . . . \$	8.15	8.15	8.15	8.15	8.15	8.15	8.15
Initial weight. . . . . lb.	10 472	10 408	9 513	10 443	10 452	10 448	10 442
Final weight. . . . . "	13 143	13 637	12 235	13 943	12 727	12 713	13 258
Total gain . . . . . "	2 671	3 229	2 722	3 500	2 275	2 265	2 816
Average daily gain . . . . . "	1.91	2.31	2.16	2.50	1.63	1.62	2.01
<i>Total feed consumed:</i>							
shelled maize . . . . . "	8 500	22 455	20 350	18 555	—	9 480	18 325
cottonseed meal . . . . . "	4 059	4 059	3 693	4 184	4 014	3 999	4 049
maize silage . . . . . "	61 635	—	—	47 425	74 495	59 710	47 891
clover hay . . . . . "	5 615	18 900	—	2 860	4 076	3 830	—
alfalfa hay . . . . . "	—	—	18 394	—	—	—	2 237
<i>Daily feed per steer:</i>							
shelled maize . . . . . "	6.07	16.04	16.15	13.25	—	6.77	13.09
cottonseed meal . . . . . "	2.90	2.90	2.93	2.99	2.87	2.86	2.89
maize silage . . . . . "	44.03	—	—	33.88	53.21	42.65	34.21
clover hay . . . . . "	4.01	13.50	—	2.04	2.91	2.74	—
alfalfa hay . . . . . "	—	—	14.60	—	—	—	1.60
Cost of gain per 100 lb. . . . . \$	17.51	19.99	21.77	17.51	14.87	20.97	21.36
Necessary selling price . . . . . "	10.50	10.95	11.18	10.50	9.35	10.43	10.96
Actual selling price in lots without shrink . . . . . "	12.00	11.75	11.75	12.00	10.75	10.85	12.00
Profit per steer not including pork "	20.93	10.85	7.74	20.93	17.80	5.30	13.84
Pork produced . . . . . lb.	1 275	1 479	1 586	1 275	748	1 035	990
Maize fed to hogs . . . . . "	1 996	2 594	2 594	1 996	4 324	3 374	1 959
Shorts fed to hogs . . . . . "	210	210	210	210	—	—	—
Tankage fed to hogs . . . . . "	210	210	210	210	—	—	—
Profit per steer including pork . . \$	35.65	27.60	28.20	35.65	21.21	14.95	25.48

(1) Fed limited grain ration.

(2) Nine steers in Lot 3.

The addition of 34.21 lb. of maize silage to a ration of shelled maize, cottonseed meal and alfalfa hay, decreased the daily maize consumption 3.06 lb. per head and the daily hay consumption 13.00 lb. per steer.

The addition of maize silage to a ration of shelled maize, cottonseed

meal and clover hay, increased the rate of gain 0.19 lb. daily per steer. The addition of maize silage to a ration of shelled maize, cottonseed meal and alfalfa hay, decreased the rate of gain 0.15 lb. daily per head.

The addition of maize silage to the ration, decreased the cost of gain \$ 2.48 per hundred pounds when clover hay was fed and 41 cents per hundred pounds when alfalfa hay comprised a part of the ration.

Maize silage in the ration increased the selling value of the cattle 25 cents per 100 lb.

The profit per steer not including pork was increased \$ 10.08 per steer by adding maize silage to a ration of shelled maize, cottonseed meal and clover hay; the profit per steer not including pork was increased \$ 6.10 by the addition of maize silage to a ration of shelled maize, cottonseed meal and alfalfa hay.

*Part II.* (A limited feed of maize as compared with a full feed of maize for fattening steers. Lots 4, 1, 6 and 5).

The elimination of maize from the ration of shelled maize, cottonseed meal, maize silage and clover hay induced the cattle to increase the roughage consumption 19.33 lb. of maize silage and 0.87 lb. of hay daily per head.

The elimination of one-half the maize in the ration of shelled maize, cottonseed meal, maize silage and clover hay induced the cattle to increase the roughage consumption 8.77 lb. of maize silage and 0.7 lb. of hay daily per head. Feeding no maize during the first month and afterwards a gradually increasing amount until the fifth month, when it amounted to 11 lb. daily per head, induced the cattle to increase the consumption of roughage 10.15 lb. of maize silage and 1.97 lb. of hay daily per head. Cattle receiving a full feed of shelled maize in addition to cottonseed meal, maize silage and clover hay, gained 2.50 lb. daily per head at a cost of \$ 17.51 per 100 lb. gain. Cattle receiving no maize in addition to cottonseed meal, maize silage and clover hay, gained 1.63 lb. daily per head at a cost of \$ 14.87 per 100 lb. gain. Cattle receiving one-half feed of shelled maize in addition to cottonseed meal, maize silage and clover hay, gained 1.62 lb. daily per head at a cost of \$ 20.97 per 100 lb. Cattle receiving a gradually increasing amount of maize in addition to cottonseed meal, maize silage and clover hay gained 1.91 lb. daily per head at a cost of \$ 18.12 per 100 lb.

*Part III* (Clover hay vs. alfalfa hay as roughage for fattening steers; Lots 2, 3, 4 and 7).

Cattle fed a ration of shelled maize, cottonseed meal and clover hay consumed slightly less maize and considerably less hay than cattle fed alfalfa hay instead of clover hay.

Cattle fed a ration of shelled maize, cottonseed meal, maize silage and clover hay consumed slightly more grain and hay but less silage than cattle receiving a similar ration with alfalfa hay replacing the clover hay.

Cattle fed hay in addition to shelled maize and cottonseed meal, gained 2.31 lb. daily per head when clover hay was fed and 2.16 lb. daily per head when alfalfa hay was fed.

Cattle fed clover and alfalfa hay in addition to shelled maize, cotton-

seed meal and maize silage gained 2.5 lb. daily per head when the hay was clover and 2.01 lb. daily per head when it was alfalfa.

Gains on cattle were made at a cost of \$ 19.99 per 100 lb. when the roughage was clover hay and \$ 21.77 per 100 lb. when it was alfalfa hay ; at a cost of \$ 17.51 per 100 lb. when the roughage fed consisted of maize silage and clover hay as compared to a cost of \$ 21.36 per 100 lb. when the roughage consisted of maize silage and alfalfa hay.

Cattle fed a ration of shelled maize, cottonseed meal and clover hay, were valued at \$ 11.75 per 100 lb. and returned a profit not including pork of \$ 10.85 per head, as compared to a value of \$ 11.75 per 100 lb. and a profit of \$ 7.74 per head when clover hay was replaced by alfalfa hay.

With maize silage added to the same ration, cattle were valued \$ 12.00 per 100 lb. and returned a profit not including pork of \$ 20.93 as compared with \$ 13.84 per head when clover hay was replaced by alfalfa hay.

**888 - The Relation of the Quality of Proteins to Milk Production.** — HART, E. B. and HUMPHREY, G. C. : I. with the cooperation of SCHAAL, A. A. II. with the cooperation of SURE, BARNETT (Department of Agricultural Chemistry and Animal Husbandry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXVI. No. 2, p. 457-471 + 4 Diagr. September, 1916; Vol. XXXI, No. 2, pp. 445-460 + 7 Diagr. August, 1917, Baltimore, Md.

I. — In 1915 the authors presented data showing marked inequality in the efficiency of the protein mixture of rations for milk production (1). These further studies furnish additional evidence that the nutritive ratio or plane of protein intake for milk production may vary according to the nature of the concentrates and basal ration used.

Data are presented on the comparative value for milk production of the proteins of gluten feed, oil meal, distiller's grains, casein, and skim milk powder. These concentrates furnished 50 per cent of the total digestible protein of the ration and were used to supplement a basal ration of maize stover, maize silage, and maize meal. The total protein intake constituted about 10 per cent of the dry matter of the ration and the nutritive ratio was approximately 1 : 8.

With a daily production of 40 to 45 lb. of milk carrying 10 to 12 per cent of total solids, negative nitrogen balance persisted throughout the experiment of 16 weeks' duration. Only during the period of skim milk powder feeding was one of the animals storing nitrogen. In spite of this long negative balance milk secretion continued at the expense of catabolizing tissue. The total yields and total solids of the milk declined slightly after 2 months of continuous negative nitrogen balance.

There was a marked difference in the utilisation of the concentrates ; gluten feed showed a percentage efficiency of 45, oil meal 61, distiller's grains 60, casein 59, and skim milk powder 60. These data represent the efficiency in the mixture used.

(1) See B. August, 1915, No. 834. (Ed.)

II. — In the preceding article the writers pointed out that the comparison would probably hold only for the mixture studied and that a different behaviour might be expected should the basal ration be varied. These expectations were entirely confirmed by the results given in this paper, which are summarised as follows:—

The concentrates involving gluten feed, oil meal, distiller's grains and cottonseed meal, furnished approximately 40 per cent of the digestible protein of the ration and were used to supplement a basal ration of maize meal, maize silage, and clover hay. The total protein intake constituted about 12 per cent of the dry matter of the ration and the nutritive ratio was approximately 1:8.5. On this low protein intake positive nitrogen balances were maintained during most of the period of observation (16 weeks) with a slow shrinkage in milk volume, but a maintenance of the percentage composition of the milk.

Earlier records showed the inferiority of the proteins of gluten feed as a supplement to the proteins of maize meal and maize stover for milk production to those of oil meal, distiller's grains, or milk. These records show an equality in efficiency between the proteins of gluten feed, oil meal, distiller's grains, and cottonseed meal as supplements to the proteins of maize meal and clover hay for milk production.

These facts must emphasize in a very striking manner the limitations of any classification of natural foods in respect to the efficiency of their proteins, based on the determination of such nutritive worth in a single food material or a single food mixture.

#### SHEEP AND GOATS

889 — **A Cross Between a Goat and a Ram, in Brazil.** — SEIXAS, DANTON DE, in *A. Estancia*, Year VI, No. 3, pp. 57-60 + 4 Figs. Porto Alegre, March, 1918.

An common 3-year black-marked goat, served by a common white ram bore two healthy kids having the characters of both the parents. A photo accompanying the article shows one of them with white wool (belonging to the author at Porto Alegre, Brazil).

#### VARIOUS ANIMALS

890 — **Study on the Land and Fresh-water Snails of Indo-China.** — DEMANGE, V., in the *Bulletin économique de l'Indochine*, Year XXI, New Series, No. 128, pp. 88-100 + 6 Plates of 27 col. Figs. Hanoi-Haiphong, January-February, 1918.

The poorer classes in Indo-China use land, and especially fresh-water, snails very largely as food, enormous quantities being consumed. The mother of pearl has only recently been exploited and will probably be of importance in the future.

A description of 20 fresh-water and 3 land species is given, together with the Latin and Annamite names.

### FARM ENGINEERING.

#### AGRICULTURAL MACHINERY AND IMPLEMENTS

891 — **Electricity in Agriculture: Consumption, Distribution and Ploughing.** — TARCHETTI, A., in *Il Giornale dell'Agricoltura*, Year VIII, N° 2, pp. 25-30, No. 3, pp. 41-46. Vercelli, February 28 and March 31, 1918.

**CONSUMPTION.** — From the standpoint of Piedmontese conditions, where the soil is mostly average, with a resistance of 40 to 60 kg. per sq. metre of soil ploughed, the author calculated that, for a normal ploughing.

at 15 to 25 cm. deep, the theoretical work per hectare would be an average of  $1,000,000 \times 50 \times 0.20 = 10$  million kilogrammetres, corresponding to a consumption of 27.2 kw.-hour, but as electric ploughs do not yield more than 50 %, the average energy consumed would not be less than 50 kilowatt-hours per hectare (1). The societies for the application of electricity to agriculture in Piedmont, where a million hectares could be cultivated in this way, ought to study the outline of the chief lines, the quality and tension of the current, and the conditions of sale of electrical energy to farmers.

**DISTRIBUTION.** — As the plough has to be moved from one field to another, the electric motor has to be supplied with current no matter where it moves. Thus a short, movable, low-tension line is needed, joined to a fixed or movable transformer cabin, which is connected to the main supply by a second, high-tension line, either fixed or loose. The author is convinced that to assure safe and easy electric ploughing, it is absolutely necessary to fix permanent secondary lines and establish transformer stations. The supply companies should be paid to fix the secondary lines and run the transformer stations themselves, without which the author is certain that there will never be any great development of electric ploughing.

The author thinks that economic and practical difficulties could be solved by using motors of as high tension as possible, always providing for the safety of the workmen, so that the low-tension line would allow of the cabin being moved without any notable fall of potential, while making it lighter and easier to handle.

Taking the case of a cable machine that can plough 100 hectares per station, there is a maximum radius of 550 metres; if the low-tension wire can be prolonged up to 500 metres from the transformer, a single station could serve about 350 hectares, which would correspond to the annual working capacity not of 1, but of 2 ploughing machines. But if a continuous current was available (or if the alternating current was transformed in the same cabin by means of a converter or a static mercury rectifier), at the same time raising the tension up to 500 volts even and eliminating anxiety for losses in yield from the 3-phase motors on account of the decrease of the power factors, the effective radius of the cabin might be increased to more than 1,300 metres, or over an area of more than 500 hectares.

It is obvious that, under such conditions, the installation cost of a short, permanent, secondary line and a fixed transformer station is slightly compensated for by the surplus energy that the station can supply without including:—

- 1) the small cost of upkeep and greater working safety;
- 2) the possibility, even the desirability, of using fixed, secondary lines of steel, iron or even copper;
- 3) the possibility of using oil-cooled transformers, surer and better

(1) In the ricefields in the Vercelli region (Sig. SEMENZA and A. TARCHETTI, "Le prove di aratura elettrica in risaia", Ed. Società An. d'Elettricità Alta Italia, 1915), on light soils (37 kg. per sq. dm.) at 23 cm. deep, a consumption of 48.3 kw.-hour, measured at the transformer, was found for a cable machine.

yielding and of such a power that several machines could be working simultaneously.

**PLOUGHING.** — The author reviews the FOWLER, HOWARD, and ZIMMERMANN (1) systems as regards their use in Italy. He notes that the last system (cable haulage) has been recently applied to a PATUZZO machine by the engineer G. GOLA. In the GOLA apparatus, the insulated and live conductor consists of a movable aerial wire parallel to the furrows, easily transportable, mounted on terminal stretchers and intermediate posts; an ingenious counterpoise arrangement assures the constant contact of the tackle, which, sliding on the line, transmits the current to the motor, through a trolley. However, the author states that it is awkward to move the line in practice, two such lines being required for continuous working, and they have to be moved every 8 or 10 yards of breadth of ploughing.

As regards direct electric traction, the author thinks that the difficulty of supplying current when turning necessitates the disuse of one-way motor ploughs, and that the system should only be applied to balance ploughs.

**892 — The Transformation of Motorcars and Motor-lorries into Agricultural Tractors and Windlasses (Landrin System).** — FREMIER, V., in *Le Génie Rural*, Year X, No. 81, pp. 9-10 + 2 Figs. Paris, 1918.

M. MARCEL LANDRIN, of Soissons (Aisne, France), has devised two arrangements for transforming existing motorcar frames and motor-lorries into agricultural tractors and windlasses.

In the first device, between the ordinary driving and steering wheels are fitted 2 large diameter driving wheels with narrow tyres, which, provided with projections on each side, give a good grip on any soil without causing any damage. These wheels are chain-driven from chain-wheels keyed onto the hub of the ordinary driving wheels. Under direct drive, the reduction gives a speed of about 3 miles per hour. The special wheels are connected to the frame by springs that allow of sufficient suppleness to avoid strain. When the vehicle runs on the road the springs of the ordinary driving wheels are free, whilst the springs of the special wheels are kept compressed, so that the latter wheels are raised some 8 inches above the ground. For work in the fields, however, the compression on the springs is reversed, by means of an easy lever-movement, and the special wheels are used for driving while the ordinary driving wheels are lifted above the ground and only serve to convey the power. The axle of the special wheels is such that it carries nearly all the weight of the frame, using it to obtain grip.

The wheel base being thus much reduced, turning is carried out in a very short radius. Turning is facilitated by independent brakes for each wheel and by detachable hoops, mounted by the side of the steering wheels and which penetrate an inch or so in the soil. The draw bar hook for at-

(1) See R., 1917, No 1202. (Ed)



taching the implements is fixed as low as possible in front of the axle of the special wheels. Traction thus helps steering while adding to the grip of the driving wheels. This device allows of a vehicle being used equally well as a tractor or for transport. The device for transforming a motor lorry into an agricultural windlass is recommended for high-powered machines. It consists of a shaft placed on the frame above the back axle. The shaft carries 2 large windlass drums with internal teeth which engage with 2 wheels fixed on the interior of the driving wheels. The reduction is such that the cable speed is 3 miles per hour, in direct drive, the engine running at its normal rate.

The cables unroll in a direction parallel to the longitudinal axis of the frame, passing through two guides; because of the large diameter of the drums and the reduced breadth of the groove, the cables unroll quite easily. The equal tension of the two cables is provided for by the differential, which is an excellent compensator.

For moving sideways the front of the frame is carried on a small truck with 4 steering wheels and the back part on 2 detachable wheels. The movement is obtained by a capstan fixed on the drums or by a small windlass hauling on a fixed point. The back axle is held by grips that keep it in the required position. To move from the field, the drums are freed from the gears, the detachable wheels are removed and the back axle freed, and the small cart removed that supported the front frame. Thus small cart, which carries the accessories, is hooked behind the frame together with the plough, so that the whole machine moves under its own power. The machine can be removed and set up again very quickly. It would be particularly useful to sugar manufacturers, as by means of it they could haul their stores with 5 to 6 ton lorries towing trailers and then plough the land of the farmers that grow sugar-beets for them.

**893 - A Study of the Plough Bottom and its Action upon the Furrow Slice.** — WHITE, E. A. (Assistant Prof. of Farm Mechanics, College of Agric. of the University of Illinois), in the *Journal of Agricultural Research*, Vol. XII, No. 4, pp. 149-182 + 26 Figs. + 4 Plates. Washington, January 28, 1918.

Geometrically exact mouldboards (plough bottoms) have often provided the basis for more perfect developments, but the results obtained by empirical plough designers were so far superior to the results obtained in the laboratory that the theories were abandoned, the makers basing their work on practical experience only.

This paper is an attempt to begin a fundamental analysis of the plough bottom and its work, in the hope that some light may be thrown on the work, and other attempts stimulated to study the theory of this important implement. The writer's work can be divided into 3 parts: — 1) a study of the forms of plough bottoms; 2) an attempt to analyse the motion of the soil particles as they pass over the surface, and 3) a mathematical analysis of the surfaces of the most important historical plough bottoms which were designed to be geometrically exact.

For this work the author developed the equation for determining the surface of a plough bottom.

In studying the motion of the soil particles in ploughing, observations were carried out in grass-land with a sod plough in order to determine the compression or stretching of the furrow slice and the movement (speed and acceleration) of the soil particles composing the furrow slice. The observations obtained are discussed in detail, and some are supported by the mathematical results obtained.

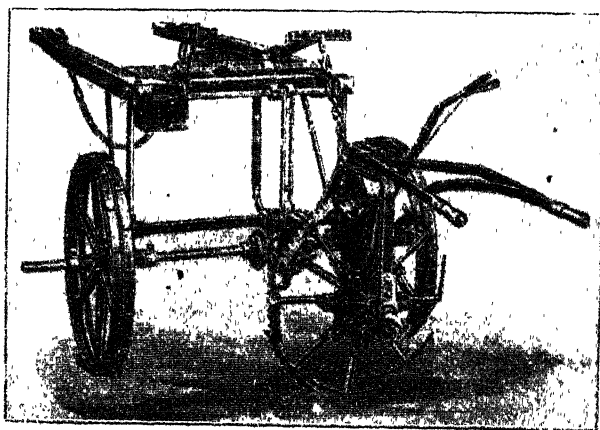
The mathematical analysis of the mould board surfaces includes a study of the mould boards of JEFFERSON, LAMBRUSCHINI, SMALL, STEPHEN, RHAM, KNOX, MEAD, and HOLBROOK.

The author also discusses mould boards by DAVIS (1818), WITHEROW & PIERCE (1839), for which he had not sufficient data to enable him to develop the equations for calculating the surface.

894 - **The Russell Turnip Thinner.** — *The Implement and Machinery Review*, Vol. XXXIV, No. 517, p. 72 + 1 Fig. London, May 1, 1918.

There exists no turnip thinner that leaves only a single plant, but with a good machine, it is possible to leave a very small bunch of plants at regular intervals. A satisfactory machine which has proved its worth has been constructed by the MALDEN IRON WORKS Co., Ltd., Maldon, Essex. It may be used for thinning roots in general.

The RUSSELL thinner shown in the appended figure is provided with a serrated cutter, which can be quickly adjusted to leave very small or large bunches of plants. The thinning apparatus is nicely balanced, and is entirely under the control of the man working the machine. If the crop is patchy, the attendant can lift the cutters so that plants required to be left in are not taken out. The machine is fitted with 5 speeds, for gapping 8, 10, 12, 14 or 16 inches, whilst the cutting apparatus and road wheels are arranged to slide along the axle to suit varying widths of row.



The RUSSELL turnip thinner.

895 - The "Universal" Electric-drive Thresher. — *Schweizerische Landwirtschaftl. Zeitschrift*, Year XLVI, No. 22, pp. 462-465 + 2 Figs. Zurich, May 31, 1918.

This thresher, built by H. WOLF & Co., of Zurich (Switzerland), includes a wagon frame mounted on 4 wheels, at the back of which is placed the closed box containing the motor. The box contains the motor, the cut-out, and a drum with 325 to 650 feet of cable. On the front of the frame a thresher is mounted with a straw shaker, caving screen, elevator and bagging device. The machine is driven directly by the motor. The belts can be tightened as required, a spring friction-roller being provided. The feeding table and the straw delivery should not be removed for transport, so that the machine can start working in a few minutes. When the threshing season is over, the thresher can be removed by unscrewing 4 screws; a circular saw or other machine can then be mounted on the frame so that the motor can be used all the year round, which is a distinct advantage.

896 - Safety Devices for Chaff-cutters. — I. MASSARELLI, F., in *La sicurezza e l'Igiene nell'Industria*, Year III, No. 6, pp. 131-147 + 19 Figs. Milan, December 31, 1916. — II. BERTONI, C., in *Il Coltivatore*, Year LXIV, No. 1, pp. 6-10, + 3 Figs. Casale, January 10, 1918.

The author considers fly-wheel chaff cutters, which are the most used, and the means of preventing the accidents that are so common with these machines. These accidents can be classified as: — a) accidents due to the fly-wheel; b) accidents due to the feed rollers; c) accidents due to the gearing and drive in general. The safety devices applied to chaff-cutters are based on two different principles: —

1) Devices stopping or changing the movement of the feed rollers and platform by quickly moving suitable mechanisms by the hand or foot. The devices, though improving the working qualities of the machine, are only relatively efficacious, as they are rather *attenuating* than *preventive* devices and should be supplemented by others.

2) Devices, automatic or not, that make it impossible to pass the arm or hand beyond a certain limit into the mouth where the forage enters. For hand-driven fly-wheel chaff-cutters, the author describes guards, made of wood, cast iron, sheet iron, or grating. As regards protection against accidents that might happen when feeding the machine, a board, fixed on the edge of the hopper, and of sufficient length, will prevent the arm passing beyond a safe limit.

One of the essential conditions for the safety of machine-driven chaff-cutters is that there should be both a fixed and free pulley together with the disengaging gear that is so often lacking in the older machines. It should be so made that the belt cannot suddenly slip from the free on to the fixed pulley and thus start the machine. A lever disengaging gear mounted on a bracket is very suitable for belt-driven chaff-cutters, which should have a guard for the fly-wheel and a lattice protecting the knives.

This lattice, even when lowered on the feed-trough, allows the workman to see the position of his hands and watch the work more closely, and as it is connected by a lever to the side mechanism controlling the cylin-

ders and feed platform, if the workman's hands happen to pass into a dangerous position, the lattice lifts, thus stopping or reversing the movement

**897 — Balance for the Direct Reading of the Lint Percentage of Cotton.** — See No. 866 of this *Review*.

**898 — The Gibaudan Alcohol-meter.** — FOURNIER, L., in *Le Génie Civil*, Year XXXVIII, Vol. LXXII, No. 19, pp. 338-340 + 7 Figs. Paris, May 11, 1918.

The Company for the manufacture of meters and supplies for gas-works, France, makes an alcohol-meter for use in agricultural and commercial distilleries, to measure separately the production of pure alcohol and distillation waters. The meter consists of a rectangular box rounded on its upper part. The front face bears the thermometric and alcohol-metric graduations on an arc of a circle placed high up, between the dials of the clockwork registering the distillation waters and pure alcohol. Two air-bubble levels enable the apparatus to be levelled. Behind are the connections by which the liquid arrives and flows away, together with a by-pass so that the apparatus can be cut out without stopping distillation.

The measurement and recording of the pure alcohol are done automatically in the new meter, which discharges in quantities equal to the capacity of an interior measuring fly-wheel (constant volume), recorded by the distillation-water clockwork, then estimates the alcohol for each of them, the pure alcohol at 15° C being shown on a second dial.

The meter includes : — 1) a measuring fly-wheel consisting of a metal cylinder with thin walls, divided internally into 5 compartments by oblique partitions and worked by the weight of the liquid, which enters by an axial pentrough and then passes from the first compartment into the second, and so on ; 2) an alcohol-meter ; 3) a thermometer ; 4) a registering device.

A detailed description, illustrated by the necessary drawings, is given of the construction of the meter ; the mechanical connection of the various parts is also described in order to show the relation between them and the device recording the volumes of distillation water and pure alcohol.

#### 899 — Review of Patents.

**TILLAGE MACHINES AND IMPLEMENTS.** — *Canada* : 181634 Plough ; 181699 Plough share ; 181935 Scraper for disc plough.

*Denmark* : 22816 Motor plough.

*France* : 486652 System of ploughing and windlass apparatus for its actuation.

*Sweden* : 41808 Moss plough.

*United Kingdom* : 114516 Combined motor plough and tractor ; 114894 Self propelled plough.

*United States* : 1261150 Stalk cutting attachment for ploughs ; 1261579 Cultivating implement ; 1261591-1262867-1262949-1262950 Ploughs ; 1261876 Clod crusher ; 1261881 Rotary harrow ; 1262176 Two furrow plough ; 1262232 Convertible hillside reversible plough, 1262253 Soil pulverizer ; 1262722 Two way plough ; 1262791-1262792-1263352 Rotary

tillers; 1262983-1264447-1264678 Harrows; 1262995 Wheeled plough; 1263422 Wheel harrow; 1263423 Harrow tooth cleaner; 1263690 Harrow attachment for plough.

IRRIGATION. — *United States*: 1261031 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Sweden*: 41960 Manure spreader.

*United States*: 1261025 Fertilizer; 1261116 Process for making a mixed potash, nitrogenous and phosphatic fertilizer; 1261117 Process of making a mixed potash and nitrogen fertilizer; 1262685 Fertilizer distributor and planter; 1263105 Seed and fertilizer distributor; 1264409 Straw spreader and grain separator.

DRILLS AND SEEDING MACHINES. — *Canada*: 181787 Potato planter.

*Sweden*: 42039 Distributor regulating device for seeding machine.

*United Kingdom*: 114455 Potato planter.

*United States*: 1261291-1262084-1264454 Planters; 1262142 Potato planter; 1262283-1264153 Grain drills; 1263070 Harrow attachment for planters; 1263105 Seed and fertilizer attachment; 1263111 Combined cultivator and seed and fertilizer implement.

VARIOUS CULTURAL OPERATIONS. — *Sweden*: 41807 Hoe for root crops; 41921 Horse hoe.

*United States*: 1261720 Cotton chopper and cultivator; 1262230 Hand cultivator; 1262418 Double cultivator; 1262800 Maize cultivator; 1264102 Four wheeled cultivator; 1264419 Plant protector.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *United Kingdom*: 114602 Powdered insecticide composed of copper sulphate and ammonium carbonate.

*United States*: 1263312 Boll weevil destroying machine; 1263965 Weed cutter.

REAPERS, MOWERS AND HARVESTING MACHINES. — *Sweden*: 41809-41810 Horse rakes.

*Switzerland*: 78221 Fruit gathering device.

*United States*: 1261020 Lawn mower; 1261202 Machine for gathering crimson clover seed; 1261241 Revolving hay rack; 1261404-1261653-1263540 Grain shockers; 1261529 Corn husker; 1261702 Attachment converting binders into headers; 1261860 Binding mechanism for grain binder; 1262030-1262031-1264575 Cotton pickers; 1262340 Guard-plate for hay rake; 1262353-1263149-1263183-1264294 Peanut harvesters; 1262658 Mower; 1262756 Conveyor-rake and stacker; 1262957 Maize shocker; 1263001 Motor driven header and binder; 1263321 Hay rake; 1264154 Stooking attachment for binders; 1264353 Hay rake and loader; 1264385 Bean harvester; 1264780 Fruit gatherer.

MACHINES FOR LIFTING ROOT CROPS. — *Denmark*: 22862-22884 Potato diggers.

*United States*: 1261139 Potato digger; 1261227 Riding beet puller; 1261333-1263529 Beet harvesters; 1263114 Separator for potato digger; 1263408 Elevating and topping mechanism for beet harvester; 1264111 Root harvester.

THRESHING AND WINNOWING MACHINES. — *Denmark*: 22879 Feeder for cleaning machines.

*Sweden*: 41851 Straw elevator.

*United States*: 1261299 Seed separator; 1261338 Feeder for threshing machine; 1261562 Band cutter and feeder for threshing machine; 1261629 Pea huller; 1261813-1262760-1263233-1263980 Threshing machines; 1262423 Maize grader and separator; 1262559 Pea and bean separator; 1263130 Green pea hulling machine.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Denmark*: 22838 Improvement to a self binding straw-press; 22890 Straw press.

*Sweden*: 41850 Knife for root cutter.

*United Kingdom*: 114435 Machine for obtaining fibre from cotton seeds and other fibre bearing seeds.

*United States*: 1261051-1261931-1263322 Baling presses; 1261522-1261997-1264171 Hay distributing apparatus; 1261651-1264615 Silage packer; 1261728 Cotton seed delinter; 1262615 Hemp cleaner.

FORESTRY. — *Canada*: 181567 Wood sawing machine; 181638 Bark-ing machinery.

*United States*: 1261760-1263495 Stump pulling machines; 1263385 Tree sawing machine.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *United Kingdom*: 114377 Agricultural tractor; 114516 Combined motorplough and tractor; 114943 Plough coupling to tractor; 114668 Harvesting machine driving mechanism.

*United States*: 1261263-1261388-1261701-1262488-1263726 Tractors; 1261584 Steering mechanism for tractor; 1261945 Chain tractor tread; 1262100-1263973 Four wheel drive tractors; 1262304 Traction engine driving mechanism; 1262456 Automatic draft releasing device for tractor; 1262625 Steering device for motor propelled plough; 1262837 Tractor driving gear.

HOUSING LIVESTOCK. — *Switzerland*: 78223 Automatic releasing device for cattle in stables or barns.

POULTRY FARMING. — *United States*: 1262397 Incubator; 1262880 Poultry perch.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada*: 181952 Bread making process.

*United States*: 1262872 Process for producing fibrous material from ricestraw; 1263742 Device for cutting and seeding peaches and other similar fruits; 1263922 Fruit paring and coring device.

DAIRYING. — *Sweden*: 41879-41880-42011 Rotary churns.

*Switzerland*: 78098-78268 Churns.

*United Kingdom*: 114713 Churn.

*United States*: 1261780-1264214 Milking machines; 1261820 Method of manufacturing a butter substitute (with butter, milk, eggs); 1263347 Teat cup claw for milking apparatus; 1264336 Sterile butter fat and method of producing the same; 1264377 Valve caging for milking machine.

FARM BUILDINGS. — *United States*: 1261454-1264689 Silos.

VARIOUS. — *Denmark*: 22903 Windmill regulator.

*United States*: 1263326 Windmill.

900 — **Rapid House Construction with Concrete Studs.** — *Engineering News-Record*, Vol. LXXX, No. 13, pp 604-606 + 3 Figs + 2 Plans. New York, March 28, 1918.

The description of a new method of house construction with fire-resistant walls made of cement stucco on metal laths.

The system proposed by Mr. E. G. PERROT, of BALLINGER and FERROT, engineers and architects, Philadelphia, allows of building 10-unit rows, each house costing, at present prices of labour and materials, about \$ 2 500, including the cost of hot-air heating apparatus. The price is as low as that of similar houses of wood frame construction and is \$ 100 lower per house than where 8-in. brick walls are used for exterior and party walls.

The concreting is carried out in one operation, in which both the frame members and stucco are placed. After the cellar is excavated a stone or concrete foundation wall is built, and the first-floor wood joists are set in place on the foundation walls. On these joists a wood frame consisting of studs, joists and rafters is erected in the usual manner of building a frame house. Every fourth stud is doubled, allowing a 3 × 4-in. space between, which is later filled with concrete to form a concrete stud. At the second-floor and roof levels a ledger board with bottom attached is placed over the studs and so arranged that the concrete when completed will be continuous from foundation to roof. On top of the ledger board the second-floor joists are set, then the second-story studs and forms. When this frame is completed, heavy waterproof paper is nailed to the outside of the exterior wall studs, leaving the space between the doubled studs open to receive the concrete. Over the waterproofed paper the metal lath or concrete reinforcement is stretched. The concrete studs are reinforced with steel rods fastened to the metal lath.

The wood studs not only support the cement stucco while it is being applied, but also serve as furring strips in the finished building. A 2-in. concrete coating is next applied on the outside, and at the same time the spaces between the doubled studs and in the ledger boards are filled to form the concrete studs and caps. The work is preferably done with the cement gun, otherwise it is done by hand. The rapidity of the work depends only upon the number of cement guns used, or the number of workmen employed.

A concrete roof may be used on such a house, but Mr. PERROT prefers wood roof framing and a fire-resisting covering (asbestos and asphalted-felt shingles, slate, and built-up roofings of felt, tar and gravel).

According to the designers this method of construction eliminates shrinkage and settlement cracks. A ten-house unit can be built in 3 weeks from the time the cellar is dug. The method is considered to be well adapted for building barracks, hospitals and one-story factories.

## RURAL ECONOMICS.

901 - Study of some Egyptian Farms. — BAROIS, C., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 13, pp. 417-427 Paris, April 10, 1918.

At the Meeting of April 10, 1918 of the French "Académie d'Agriculture", the author described some capitalist farms in Egypt with the intention of pointing out to the French public the advantages capitalist colonial agricultural enterprise, if well managed, may offer to French investment. Five farms, those of *Kom-Ombo*, *Cheikh Fadl*, *Ouady Toumilat*, *Sakha*, and *Santa* were studied.

**KOM-OMBO FARM.** — In 1903 a company bought from the Egyptian government 32 124 acres on the banks of the Nile in a plain 1760 miles south of Cairo by 24.5° northern latitude. It was absolutely desert land, never reached by the waters of the river, with a minimum height of 37.16 to 49.20 feet above low water level. The soil was not composed of Nile alluvion, but of deposit from the neighbouring valleys. The climate was tropical. These 32 124 acres cost £ 11 597, or about 7s. 2d. per acre.

The problem to be solved was to raise mechanically and distribute the water of the Nile in all seasons to the highest point of the estate, and to render fit for cultivation land which had not only never been cultivated, but had never borne any kind of plant. Four powerful pumps of 1 400 HP., each with sheet steel delivery pipes 6 ½ feet in diameter and 1640 feet long were installed, 110 miles of road, 121 miles of railway, and about 220 miles of canal were built, numerous buildings for the pumps, staff, peasants (school, mosque, hotel, etc.) erected, and the land levelled and prepared.

The total cost of the original installation was nearly £981 310, or £4. per acre for the 22 980 acres now under cultivation. The estate, uninhabited before the work began, now counts a population of 20 000 inhabitants.

After five years of not always successful experiments in the growing of cotton besides cereals, beans and fodder (winter crops), and maize (alternate summer crop), cotton is at last being replaced by sugar cane. In 1916, the cultivation of sugar cane which covered only 27 % of the area cultivated, brought in a gross profit of £150 666, as compared with £79 298 from all the other crops together.

The annual farming expenses are £194 280, corresponding to £8.10.0 per acre, including 14s. in taxes. These figures include £1.18.6 per acre for raising the water, and, in 1913, represented a profit of 5 ½ %.

The land is cultivated either by the tenants for the ordinary crops, or in conjunction with the fellahs and the company for these crops and for cotton, or directly for sugar cane. In all cases the pumping expenses are met by the company. For direct cultivation the estate is divided into farms of 1 977 to 2 471 acres, each with its directing staff, workmen and material. The utilisation of motive power from the Assouan dam and the adaptation of cotton to the land improved by irrigation are expected to make the enterprise very prosperous.

**CHEIKH RADL FARM.** — This farm is situated in central Egypt, a district suited to the production of cotton and sugar cane. It is an example



of an estate, previously fairly badly managed, taken over by a company, improved by it, and cultivated exclusively by farmers. The land is on the right bank of the Nile, between the river and the Arabian plain. It does not receive the river water directly, and can only be irrigated by pumping; it is of average quality.

The estate contains 9 204 acres. The company with a capital of £594 700 bought it from the Egyptian Government in 1900. The cost of the original installation was:—land (cost and preparation), £566 000; buildings, £24 680; machines and steam-ploughs, £33 750; dredging machines, £11 410; miscellaneous expenses, £7 070, or a total of £632 910, and represents an outlay of about £70 per acre.

All the land is let out to farmers. The irrigation water is supplied by the company.

Besides cereals, beans, maize and clover, which are included in the rotations, the principal crop is sugar cane. The chief tenant is a large sugar company which cultivates 6 857 of the 9 204 acres of the estate. The receipts for 1915-1916 were:—rents, £46 620; miscellaneous receipts, £660; interest, £1 380, or a total of £46 660. The expenditure was:—farming expenses, £11 280, general expenses £3 140, a total of £14 420. There was, therefore, a profit of £32 240. The average rent is £5 per acre, and the company's annual outlay about £11.11.0 per acre. Each year the company pays its shareholders 5 ½ % and in 1916, after 15 years' existence, its reserve fund exceeded £39 650.

**OUADY TOUMILAT FARM.**—This farm is of a totally different character. It is an estate of 21 250 acres, most of which has deteriorated owing to the infiltration from a large public canal. In 1891 only 7 412 acres were still cultivated, 3 460 acres were occupied by canals or were fallow, and 10 378 acres were considered suitable for cultivation if drained.

The estate is in a hollow in the desert between the Delta and the Suez Canal. It was exploited by the administration of the Wakfs (religious mortmain) and the profits devoted to the maintenance of the Government schools. From 1892 to 1895, £29 130 were spent on 'building':—1) a water-raising plant with four large centrifugal pumps to raise the drainage water to a height of 8.85 feet in the neighbouring Lake Mahsamah; 2) a feeding canal over 48 miles long; 3) a drainage canal over 13 miles long.

Owing to the neglect of the Wakfs these works did not improve the condition of the estate, and, in 1899, the area suitable for cultivation had not increased. The Ministry of Public Works then undertook the management of the estate with the intention of completing the drainage works as well as of clearing the 10 378 acres capable of being reclaimed for cultivation.

The necessity of increasing the power of the water-raising plant and to empty the overflow from Lake Mahsamah into the Suez Canal by means of a canal nearly 55 miles long was first recognised. By the end of 1906 7 265 acres had been reclaimed for cultivation and only 3 113 acres remained to be cleared. The advance money for the works, amounting to £46 400 had been entirely repaid to the Wakfs from the profits from the farm; the taxes of £5 947 had been paid regularly and, in addition, an annual income of

£8 250 had been paid to the Government schools. The work of clearing was then continued using the annual profits, which increased progressively. In 1916, when the work of clearing had been finished, the net income of the estate was £31 323, or about £11.15.0 per acre cultivated.

In the Ouady Toumilat district the soil is light and of inferior quality. As throughout all Lower Egypt the principal crops are cereals, clover, maize, and cotton.

The agricultural population which in 1891 was reduced to 4 500 inhabitants, is now 17 000, about 5 000 of whom are workmen. Thanks to the reclamation work undertaken since 1891, the cost of which has exceeded £99 120, or £9.10.0 per acre reclaimed, this estate is once more prosperous.

**SAKKA AND SANTA FARMS.** — These are two estates with abundant yields situated in the best part of the Delta. The SAKKA estate with 6 412 acres of good, average quality land, is managed by a State Administration called "Egyptian State Properties", that is to say, it is methodically, but expensively managed, as is the case with all State administration.

The land is partly cultivated directly by the Administration, partly leased yearly, let to workmen for a quit-rent, or leased for special crops. In 1912, 4 146 acres were being directly cultivated with the following rotations and yields: —

Wheat, 410 acres, 19.08 bushels; barley, 175 acres, 33.28 bushels; beans, 640 acres, 22.65 bushels; clover, 783 acres; cotton, 1 907 acres, 2.93 cwt.; gardens, 10 acres.

The Administration reserves the cultivation of cotton exclusively to itself, leaving that of maize to the tenants. The receipts for the whole estate, including the crops grown directly, rents and quit-rents were £44 682, the expenditure £25.144; the balance, therefore, is £19 538. The receipts amount to £7 per acre, the expenditure £4, and the profits £3. The taxes are 16s. per acre.

The SANTA farm, in Lower Egypt, is also demesial, and has land of the best quality. It contains 11 794 acres, 6 635 of which are cultivated directly and the remainder by annual leases and quit-rents, like the Sakka estate.

The results are superior to the preceding ones. The rotations and yields for the crops grown directly were, in 1912: — Wheat, 1 243 acres, 29.90 bushels; barley, 655 acres, 49.54 bushels; beans, 329 acres, 20.02 bushels; clover, 1 517, 20.65 bushels; cotton, 2 874 acres, 4.13 cwt; gardens, 15 acres.

For the whole estate including crops cultivated directly, leases and quit-rents, the receipts were £139 043, the expenditure £63 220, and the profits £75 823. This represents receipts equal to £11.16.0 per acre, expenditure of £5.7.0 per acre, and profits of £6.9.0 per acre. The taxes are £1.9.10 per acre.

These examples show the profits which might be derived from similar districts in the French colonies, so long as individual initiative is supported by sufficiently large capital aided by competent management. Above all such large enterprises should not be entered upon before the subject has been thoroughly studied and numerous extensive experiments made.

902 - **Studies in the Cost of Market Milk Production in the United States.**—ANDERSON, A. C. and RIDDELL, F. T. (Michigan Agric. Exp. Station), in *The Journal of Dairy Science*, Vol. I, No. 2, pp. 181-184. Baltimore, July, 1917.

The data presented in these studies cover a period of two years, from 1914 to 1916, and include figures from 25 farms near Grand Rapids, Michigan. Most of the other figures secured on this point in the United States were collected in New England or Atlantic Coast States. The data were secured by a one day visit to each farm monthly. All the farms visited produced market milk, some of them being dairy farms solely, although most of them were coupled with grain, vegetables, live stock or fruit production, and each farm was conducted according to the ideas of the owner or operator. The average expenditures of the farms visited were as shown in Table I.

TABLE I. — *Average expenditures.*

Items of expenditure	1914	1915
Total number of farms . . . . .	25	25
Average number of cows per year . . . . .	459.4	428.57
Man labour . . . . .	\$ 28.68	27.19
Hauling milk and other horse labour . . . . .	15.54	14.77
Feeds:		
Roughage . . . . .	31.02	30.38
Concentrates . . . . .	28.61	26.68
Pastures . . . . .	8.36	7.60
Cash sundries . . . . .	1.96	1.77
Veterinary services and drugs . . . . .	0.86	0.99
Taxes, interest and depreciation on herd . . . . .	9.88	9.49
Taxes, interest, insurance and depreciation on buildings . . . . .	8.72	10.33
Depreciation on barn tools and dairy utensils . . . . .	0.50	0.48
Actual losses on live stock . . . . .	1.95	6.25
Added earning power of owner due to knowledge, experience, and interest in excess of that possessed and used by ordinary labour . . . . .	6.00	6.00
Added risk due to instability of market for product as whole milk, which in single years amounts to 30 per cent, and in one year out of every five would be 6 per cent . . . . .	8.47	8.30
Total . . . . .	150.57	150.29

The average receipts of the farms visited, for the dairy, were as shown in Table II.

The authors bring in a new point, that of "instability of market for product as whole milk" which in a single year may amount to 30 per cent and occurs, as they estimate, one year in five, which would be 6 % of the total cost of production, in this case \$ 8.47 for 1914 and \$ 8.30 for 1915.

TABLE II. — *Average receipts.*

Items of receipts	1914	1915
Average pounds of milk produced . . . . .	6 928 lb	7 156.8 lb.
Gallons of milk produced . . . . .	834.70 gal.	862.3 gal.
Average price per gallon delivered into Grand Rapids.	16.90 cents	16.35 cents
Value of milk produced . . . . .	\$ 141.35	\$ 139.01
Credit by manure . . . . .	17.45	17.59
Total value of products per cow . . . . .	158.80	156.60
Net profit per cow . . . . .	8.23	6.31
Cost of production per gallon . . . . .	15.90 cents	15.39 cents
Net profit per gallon . . . . .	1.0 cents	0.7 cents
Cost of production and delivery per hundred pounds .	\$ 1.916	\$ 1.854
Cost of production per quart . . . . .	3.475 cents	3.848 cents

The investment on the farms studied, expressed in percentage is as follows: —

Investment in cattle . . . . .	45 %
Investment in buildings . . . . .	54 "
Investment in equipment . . . . .	1 "

For 1915 the distribution of cost factors was as follows, expressed in percentage: —

Grain . . . . .	17.8 %	Taxes, interest and depreciation	
Roughage . . . . .	20.2	on buildings . . . . .	6.9%
Pasture . . . . .	5.1	Same on cows . . . . .	6.3
Hauling milk . . . . .	9.8	Losses on cows (tuberculosis, etc.)	4.1
Man labour . . . . .	18.1	Management . . . . .	4.0
Market losses . . . . .	5.5	Depreciation on tools, etc . .	0.3
		Veterinary services . . . . .	0.7
		Cash items . . . . .	1.2

The authors point out that during the last two years the cost of labour has increased 25 %, concentrated feeds 30 to 35 %, roughage 10 %, and minor supplies and milk room equipment 25 to 60 per cent.

## AGRICULTURAL INDUSTRIES.

### INDUSTRIES DEPENDENT ON PLANT PRODUCTS

903 — *The Intrinsic Values of Grain, Cottonseed, Flour and Similar Products, Based on the Dry-Matter Content.* — BOERNER, E. G., *U. S. Department of Agriculture, Bulletin* No. 374, pp. 1-32 + 12 Tables + 3 Figs. Washington, D. C., October 17, 1916.

The moisture content of grains or cottonseed varies with the season, the part of the country in which they are grown, and the way they are handled and stored after being harvested. The minimum and maximum moisture content of grains, cottonseed, or their manufactured products generally varies between 10 to 30 %; new maize, however, frequently exceeds this maximum; whereas thoroughly dry small grain and cottonseed may contain less than 10 % of water.

All else being equal the value of grain, cottonseed, flour, meal, etc., to the consumer is in proportion to their content in dry matter. Moreover moisture is a serious hindrance to good keeping; enormous quantities of grain and cottonseed are seriously damaged each year by moulds and fermentation because their moisture content is too high for safe storage or transportation, and the danger of such damage increases with each additional percentage of moisture.

The value of a low moisture content has long been recognised in the trade, where the rules governing the grading of grain lay down that grain, to be classed in the higher grades must be "dry", in the intermediate grade "reasonably dry", and in the lowest grades "damp" or "wet". This classification is very indefinite, but it was only in 1916 that rules giving definite maximum limits of moisture for the various grades of corn were drawn up by the Grain Dealers' National Association, and adopted by the State grain inspection departments and grain exchanges. In 1914 the Department of Agriculture drew up grades for commercial maize and fixed definite limits of moisture for each of the six numerical grades. These grades are now in force in most of the maize markets in the United States. In certain States the pure-food laws also deal with the amount of moisture grain and flour may contain in order to enter the State.

When a unit of weight of grain, cottonseed, etc., containing excess moisture is dried naturally or artificially to a lower moisture content, the weight is reduced by the loss of water, but all the dry matter is retained. As only the dry matter is considered as having any value the total value before and after drying will be the same. The comparative value of the dry matter is, therefore, of great importance. The author gives a series of tables by which the comparative value, on a dry-matter basis, of grain, cottonseed, flour, etc., containing various percentages of moisture and quoted at various prices per unit of weight, may be easily and rapidly calculated. These tables show that the difference in value for each 1 % of dry matter increases in direct proportion to the increase in price, so that, as the price of the product increases, the difference in value for each 1 % of dry matter or moisture becomes of greater importance to the producer and consumer. Moreover, it is clear that if a dry product commands a better price than one with a high moisture content the farmer will be encouraged to improve his methods of farming and storing.

Grain, especially maize, is frequently put on the market with a moisture content too high to remain sound during storage or transportation, and has to be dried by machine. Whether dried naturally or artificially the shrinkage in weight of such grain is always greater than the difference in the percentage of moisture content before and after drying, as shown by the moisture tester, unless all the moisture is dried out, when the shrinkage and the reduction in moisture are equal. In order to facilitate the estimation of this percentage, the author gives a table by which the shrinkage may be determined when the original moisture content and the moisture content after drying are known. He also gives formulae for finding the percentage of shrinkage corresponding to any reduction in moisture content and for finding the weight of the dried

material when the original weight and the moisture content before and after drying are known.

In drawing up the tables only the fundamental factors of moisture and dry matter were considered; there are, however, other factors of equal importance in the buying and selling of cottonseed flour and other products, among which may be mentioned: — 1) the relative quantity of damp grain in the grain-producing States that have a surplus, or in the district bordering on any given grain market, and the relative quantity of the market receipts; 2) the tendency of damp grain to deteriorate during storage or transit, and the increased danger of such deterioration as the moisture content increases; 3) the conditions of supply and demand at the time of marketing, and the relative capacity of the markets to absorb or dispose of damp grain at a profit; 4) weather conditions at the time of marketing and future weather conditions which may affect the condition and carrying capacity of the grain; 5) the extra cost incurred by the artificial drying of the grain and by the freight on the water handled; 6) the slight "invisible loss" in weight during the drying process.

904 - **The Utilisation of Sisal Waste for the Production of Alcohol.** — *Tropical Life*, Vol. XIII, No. 10, p. 155. London, Oct., 1917; Abstract in the *Bulletin économique de l'Indochine*, Year XXI, No. 128, New Series, Hanoi-Haiphong, January-February, 1918.

After the fibre has been extracted from sisal there remains much waste, which has a very disagreeable smell and, when possible, is used as a fertiliser. Investigations have been made to see whether this waste can be put to a more profitable use. The experiments dealt partly with its utilisation for paper-making and partly on the extraction of alcohol from the leaves and stems.

The experiments, made in British East Africa, show it is possible to extract alcohol from sisal. An analysis of the juice of the leaves showed the plants from the coast as well as those from the Highland to contain 3 % of sugar. At Yucatan, whence sisal was first exported and where alcohol has been made from the waste and put on the market, the sugar content was never below 9.4 %, and sometimes, after a long dry season, reached 14.1 %. Most of the alcohol was made from leaves containing 12 % of sugar.

A yeast was isolated from sisal plants which fermented a glucose solution but was quickly killed in the sisal extract. This was no doubt due to the large quantities of organic acids present. After neutralisation with sodium carbonate and the addition of a small quantity of glucose it was found possible for the yeast to live in the sisal extract, but no fermentation took place.

905 - **The Beet Sugar Industry in the Netherlands.** — GOOSSENS, G., in *In en Uitvoer*, Year III, Nos. 7 and 9, pp. 151-152 and 200-202. Antwerp, February 13 and 27, 1918.

After giving an historical survey of the beet sugar industry in the Netherlands the author gives the figures for the production of sugar in that country from 1864 to 1916. In 1864 there were only 6 refineries with a production of 3 700 metric tons of sugar, an average of 617 tons per factory.

In the period 1899 to 1900, 31 refineries were working and producing 71 092 metric tons of sugar, an average of 4 940 per factory. The 28 refineries working during 1912 to 1913 produced 279 000 metric tons, an average of 9 980 each. In 1916 the 28 refineries only produced 247 209 tons. A table giving the average yield of sugar beets per acre from 1908 to 1914 shows that, in 1908-1909, the yield was 260 cwt. of roots with a 16.80 % sugar content, yielding 43.75 cwt. of sugar. After dropping, in 1909, to 217 cwt. of roots containing 15.5 % of sugar, and yielding 33.58 cwt. of sugar per acre, the average yield of sugar beets rose in 1911-1912 to 286 cwt. of roots, containing 16.57 % sugar and yielding 47.61 cwt. of sugar per acre, and in 1913-1914, again dropped to 219 cwt. of 16.55 % roots giving 36.25 cwt. of sugar.

Besides the beets produced in the country the refineries also deal with beets imported from Germany. On the other hand the Netherlands also export beets into Belgium to be used by the factories there. The author considers the sugar position in the Netherlands during the last three years, and concludes that the production for 1917-1918, estimated at about 200 000 metric tons, will be sufficient to meet the demand for beet sugar there in 1918, which is estimated at about 170 000 metric tons.

906 - **The Fat of the Residue of the Decortication of Rice.** — GARELLI, FELICE, in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LX, pp. 132-139. Turin, 1917.

The annual production of rice in Italy exceeds 11 760 000 cwt.; the residue from decortication ("pula di riso") represents 980 000 cwt. and contains about 147 000 cwt. of oil. This residue is composed of the perisperm, embryo and part of the outermost starch layers of the caryopsis, to which, in the trade, are added varying quantities of husks. Without the husks it represents 7 to 8 % of the weight of the rough rice, but the commercial type represents about 10 % of this weight. Up to the present it has only been utilised in part as a food for cattle (1), and before the war, the greater part of it was exported (chiefly to Switzerland and Germany) and sold on a basis of its total fat + protein content, which varied from 15 or 16 % to 24 or 26 %.

By removing the fat from this product its keeping quality is improved, it is made more healthy (the fat is slightly irritating and relaxing) and easy to transport. The extract is of great value, especially at this moment when all the war industries require so much fat. Experiments on the extraction of this fat were, therefore, made.

Repeated pressure under 300 atmospheres each of nearly 2 cwt of meal, previously moistened and heated, gave an average yield of 6.5 % of crude oil. The properties and characters of the fat vary greatly, especially according to the state of preservation of the residue, and also according to the method of preparation (by compression or volatile solvents). That prepared by compression is liquid at ordinary temperatures; it is a true oil with a density of 0.912, of a greenish-grey colour. The cake obtained by this method is similar in appearance to that of sesame seed.

(1) See R. 1917, Jan., No. 56; Aug., No. 739; Oct., No. 933. (*Fd.*)

The crude residue of decortication contains 2.38 % of nitrogen, corresponding to 14.87 % of crude protein which, together with 15.23 % of fat, gives a total value of 30.1 %. In the dried cake this value is 33.8 % (16.7 % of crude protein and 17.1 % of fat).

The extraction of this fat is of great value, and should be started immediately, leaving till later a detailed study of the possibility of complete extraction by volatile solvents. By the compression method it would be possible to obtain 39 200 to 58 800 cwt. of excellent oil for the manufacture of soap, fatty acids and glycerine.

907 — South African Paper-making Plants. — See No. 869 of this Review.

INDUSTRIES  
DEPENDENT  
ON ANIMAL  
PRODUCTS

908 — A Substitute for Litmus for Use in Milk Cultures. — CLARK, W. M. and LUBS, H. A. (Research Laboratories, Dairy Division, Bureau of Animal Industry, U. S. Dept. of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No. 3, pp. 105-111. Washington, D. C., July 16, 1917.

The colour changes which occur in litmus-milk cultures may be due to changes in the hydrogen-ion concentration of the medium or to reduction or even destruction of the dye. If it is the degree of acid or alkali fermentation which is sought, it is advisable to use an indicator which will not be affected except by a change in the hydrogen-ion concentration. Dibromooorthocresolsulfonphthalein, for which the short name bromcresol purple is suggested, fulfills this condition.

Litmus undergoes a temporary reduction during sterilisation in the presence of milk. Bromcresol purple does not. The colouring power of litmus is relatively weak; bromcresol purple in very high dilution is useful. Litmus and azolitmin are indicators of uncertain composition; bromcresol purple is a definite individual compound obtainable in crystalline form and therefore reproducible. The impurities of litmus preparations vary in their effect upon the hydrogen-ion concentration of milk and often necessitate elaborate adjustment either of the litmus solution, of the milk, or of the mixture if reproducible colour is to be obtained. Bromcresol purple, on the other hand, may be used with the assurance that, if other conditions are constant, it will always produce the same colouration.

Some of the difficulty experienced in reproducing a particular initial colour with either indicator is shown to be due to the changes in hydrogen-ion concentration which occur when milk is sterilised by heat.

The comparative value of litmus and bromcresol purple in milk cultures was tested with a variety of organisms. It was found that no change in reaction could be observed with litmus which could not be followed equally well with bromcresol purple. In many instances litmus was rendered useless by reduction or destruction while bromcresol purple continued to act a true indicator of the hydrogen-ion concentration.

909 — Preliminary Note on Certain Changes in Some of the Nitrogenous Constituents of Milk Caused by Bacteria. — SUPPLEE, G. C., in *The Journal of Dairy Science*, Vol. I, No. 4, pp. 313-319. Baltimore & London, November, 1917.

The data presented in this preliminary note are the result of a preliminary investigation on certain quantitative changes in the nitrogenous



constituents of milk caused by bacteria before any change in the physical appearance of the milk is evident.

The following species of bacteria were used: *Bact. lactis acidi*, *Mic. albidus*, *Ps. liquefaciens*, *B. lactis viscosus*, *B. mycondes*, Acid peptoniser (species unknown), *Bact. bulgaricum*, *B. coli communior*, *Bact. aerogenes*, *B. prodigiosus*, *Ps. pyocyaneus*, *B. subtilis*.

The plan of the analyses was one of fractional precipitation by various precipitating reagents and the subsequent determination of the nitrogen in each of the fractions.

In many instances the changes in the nitrogen content of the various fractions were very slight. Many of the results, however, were beyond the realm of experimental error. A study of the tables presented reveals the following general results:—

All organisms tested except two caused a decrease in the casein fraction and in most cases this decrease was more marked with those organisms known to possess extreme proteolytic properties. With some organisms there was an increase in the albumin fraction, with others a decrease in the albumin fraction and little or no decrease in the casein fraction. The changes in the nitrogen content produced under these conditions will serve as a preliminary basis for further work.

**910 - Experiments on Determination of Cow Manure in Milk; Moisture Content and Solubility of Cow Manure.**—TAYLOR, G. B., in the *Journal of Dairy Science*, Vol. I, No. 4, pp. 303-312. Baltimore & London, November, 1917.

A series of experiments was conducted on cow manure from the experimental farm at Beltsville to determine primarily whether the manure in unstrained milk can be measured quantitatively by chemical methods. A method was found which gave good results provided the original quantity of manure present was fairly large. For average milks, however, this chemical method is impractical on account of the fact that, while manure is always present, it is as a rule in such small amounts that it cannot be measured chemically.

The experiments lead to the conclusions given below.

**Conclusions:**—The moisture in the cow manure examined averaged nearly 83 per cent. Air dry manure contains about 6 per cent of moisture; 5 per cent of the remaining solid matter is soluble in milk. This would indicate that only 11 per cent of dry manure dissolved in milk, 6 per cent of this being water. Nearly 85 per cent of fresh cows' manure will dissolve in milk, 83 per cent. of this being moisture. Manure in whatever condition is less soluble in milk than in water. Of the manure present in bottled milk, 91 per cent will be visible on the bottom, leaving 9 per cent of foreign matter in suspension.

**911 - Methods Adopted in the Production of "Clotted Cream" in Devonshire and Cornwall, England.**—SADLER, W., in the *Journal of Dairy Science*, Vol. I, No. 4, pp. 291-302. Baltimore & London, November, 1917.

Enquiries have been conducted on behalf of the Board of Agriculture as to the methods adopted by the producers of "clotted cream" in the counties of Devonshire and Cornwall in England. Experiments have subse-

quently been undertaken at the Midland Agricultural and Dairy College, Kingston, Derby.

The results of these experiments so far tend to show:—

1) That provided a suitable system be adopted and reasonable care be taken in management and manipulation, clotted cream having the typical and characteristic properties can be produced in any district.

2) That, while a rich milk is preferable, it is not at all essential for the production of characteristic clotted cream to have only the breeds of cattle favoured by the producers in Devonshire and Cornwall.

3) That the flavour and keeping properties of the cream are problems of a bacteriological nature.

4) "Scalding" for 20 to 30 minutes with a final temperature of 187° F proved to be a satisfactory procedure.

5) One pound of clotted cream was produced from 23 pounds of milk.

6) The average percentage of butterfat in the clotted cream was 62 to 64 per cent.

7) The average butterfat content of the scald milk was 0.75 per cent.

912 - **Studies in Butter Shrinkage.** — GUTHRIE, E. S., in the *Journal of Dairy Science*, Vol. 1, No. 2, pp. 136-138. Baltimore, July, 1917.

The Dairy Division of the Cornell University has completed the storage studies of 100 tubs of butter. This butter was made in eight different churnings from sweet pasteurised cream. The body was good and the moisture was nicely incorporated. All the butter was overworked somewhat, which has a tendency to complete the incorporation of the water. The tubs were paraffined, and were weighed just before the butter was packed in them. The butter was weighed on November 20 after being in cold storage for 134 days at 0° to 10° F. The shrinkage or increase in weight was determined for each tub.

Seventeen packages showed an increase in weight ranging from 0.5 ounce to 27.5 ounces. Eighty three tubs showed shrinkage which varied from 0.5 ounce to 15.5 ounces. The total shrinkage was 377.5 ounces. The total increase of weight was 85 ounces. The net shrinkage was 292.5 ounces, or 18.28 pounds, which is 0.1828 pound for tub or 0.29 per cent.

913 - **The Relation of *Oidium lactis* and *Penicillium* to the Keeping Qualities of Butter.** — COMBS, W. B. and ECKLES, C. H., in the *Journal of Dairy Science*, Vol. 1, No. 4, pp. 347-355. Baltimore and London, November, 1917.

The primary object of the experiments reported in this paper was to determine the relation of *Oidium lactis* and a mould of the *Penicillium* group to the keeping qualities of butter, especially when these organisms had developed in the cream before churning. Only a portion of the data taken during the experiments is given, but the results were consistent and conclusive.

It was found that moulds do not grow readily upon butter, but their growth is influenced by the amount of protein, salt and moisture the butter contains and the moisture of the surrounding atmosphere.

The quality of cream as usually judged by taste is influenced to a marked degree by the growth of *Oidium lactis* and *P. Chrysogenum* when the cream is sweet, but no objectionable flavour can be detected in the cream as a result of mould growth when the cream is sour.

The growth of *Oidium lactis* or *Penicillium* upon cream exerts a decidedly detrimental effect upon the keeping qualities of the butter.

Mould spores do not germinate or make growth in butter. The growth of mould on butter is the result of a contamination from the outside.

Pasteurisation at ordinary temperatures greatly improves the keeping qualities of butter made from cream upon which moulds have made growth, but it does not entirely check the action of the enzymes which they produce. This action may be checked entirely by heating to a sufficiently high temperature but this point is beyond the limit of practicability for commercial use.

The abnormal flavours which develop in butter due to mould growth on the cream, are caused by enzymes which are secreted by the mould in the cream.

914 - **Varieties of Cheese: Descriptions and Analyses.** — DOANE, C. F. and LAWSON, H. W., in *U. S. Department of Agriculture, Bulletin No. 608*, pp. 80 + Bibliography of 103 publications. Washington, March 6, 1918.

This bulletin gives descriptions of 287 different cheeses and analyses of 129 varieties extracted from the books and technical periodicals of the producing countries. The varieties are arranged in alphabetical order. It is pointed out that one type of cheese is frequently known under different names, thus making classification difficult.

915 - **Study on the Normal Production of Gas in Cheese: Investigations at the Agricultural Experiment Station of Hoorn, Netherlands.** — BOEKHOUT, F. W. and VRIES, J. J. OTTIE, in *Verslagen van Landbouwkundige Onderzoekingen de Rykslandbouwproefstations No. XXI*, pp. 14-28 + 1 Plate. The Hague, 1917.

The authors undertook an investigation into the gas-producing organisms of cheese. As culture medium they employed that used by VON FREUDENREICH and JENSEN for the study of propionic fermentation in Emmenthal cheese. The constituents of this medium, which contains peptone and calcium lactate, are very similar to the nutritive matter of cheese which may be attacked by the organisms.

Samples of 4 to 5 weeks old Gouda and Edam cheese with many holes, were crushed with a physiological salt solution and put with VON FREUDENREICH'S nutritive liquid into glass tubes, which were evacuated, sealed, and kept at 21° C. The tubes were opened and the contents used as inoculation material wherewith to repeat the operation. The final product was grown on gelatine.

1) **CHARACTERISTICS OF THE BACTERIUM.** — The authors succeeded several times in isolating the bacterium responsible for the production of gas in cheese. It is rod-shaped, 1.75 to 3  $\mu$  long and 1.2  $\mu$  broad. Milk is not a good culture medium. As a source of nitrogen the bacterium requires peptone, and calcium lactate as a source of carbon. The gas produced is a mixture of carbonic acid, hydrogen and nitrogen. Cultures

of this bacterium have very great vitality and contain living bacteria after 10 months. The optimum temperature is about  $21^{\circ}$  C.; a lower temperature, 10 to  $12^{\circ}$  C., greatly reduces development, and that of  $55^{\circ}$  C is fatal.

2) INFLUENCE OF SALT AND LACTIC ACID. — The influence on the bacterium of varying quantities of salt and lactic acid added to the peptone and calcium lactate solution was then studied. The experiment was continued with the sealed tubes to which were added increasing quantities of salt and lactic acid. Including the salt already contained in the nutritive solution; the maximum quantity tolerated is 4.5 %; the maximum concentration of lactic acid is 0.3 %. When the lactic acid concentration is only 0.1 % a salt concentration of 4.5 % allows fermentation at the end of 21 days, and a concentration of 5.5 % at the end of 1 month.

3) REDUCING PROPERTIES. — The presence of hydrogen in the gas produced shows reducing properties. In the culture medium containing 0.03 to 0.05 % of nitrates there is reduction and transformation of the nitrates into nitrites, the final reduction of the latter being rather slow. If, however, the culture medium contains only nitrites they are completely reduced. (The same reduction phenomenon occurs with sodium nitrites and potassium chloride). Fermentation occurs only when the nitrates have been reduced, and this influence on the bacterium is the same in cheese as in culture media. Edam cheeses made with pasteurised milk were inoculated with the bacterium and 0.05 % of potassium nitrate; cheeses without nitrates were used as controls. In some of the cheeses there was no fermentation even after 10 or 20 days and the nitrates were still present. In those in which fermentation had taken place the nitrates had disappeared. Fermentation occurred in all the control cheeses (without nitrates).

As a rule, as soon as the bacterium has no more free nitrogen at its disposal it attacks the calcium lactate (formed in the cheese by the lactic fermentation). Carbonic acid and hydrogen are thus formed, causing cracks and holes in the cheese. The composition of the gases in the cheese is similar to that of the gases given off in the culture medium.

The authors were unable to isolate butyric ferments in the cheeses by this method and concluded that these ferments take no part in normal gas production and the formation of cracks.

916 - The Growth of Green Mould (*Penicillium glaucum*) for the Manufacture, of Blue Cheeses. — CHAVASTELON, K., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 18, pp. 564-566. Paris, May 22, 1916.

The author (Professor of general and agricultural Chemistry in the Faculty of Science at Clermont-Ferrand) describes a simple and practical method of growing *Penicillium glaucum*.

Bread is cut into slices 1 to 1.5 cm. thick, and soaked for about 10 minutes in a solution containing 35 to 37 gm. of tartaric acid per litre. The slices are then laid flat on frames made of reeds, about 5 to 6 mm. thick with a distance of 1 to 2 cm. between each, or, if need be, on straw mats; both must be previously scalded. The slices are sprinkled on both sides with green mould spores and the frames, which may be placed one

on the other, left in a damp place in which the air is always near its saturation point or, if speed is necessary, at a constant temperature of about 25° C.

If the damp condition is maintained fine cultures are obtained at the end of 16 days for temperatures of 14 to 18°, and at the end of 31 days if the temperature is about 8°. The production is maximum if the slices are turned over on the frames or mats once or twice during the period of culture so that all the parts are regularly aired.

To maintain the desired degree of moisture, in a simple installation, coarse sacking or matting, the ends of which are constantly in water, may be hung in the room.

The cultures are collected when the slices, which have become very thin, are uniformly green on both sides; this does not always occur. They are then dried in the air before being pulverised or passed through a mill. The fine powder, which only contains a very small proportion of the original bread, and, in the multitude of its spores, represents a very concentrated and almost pure culture, is kept in boxes.

If the operation is well carried out 20 lbs. of bread will suffice to sprinkle many thousand pounds of cheese.

917 - **Researches on the Physical and Chemical Constants of the Oily Matter of the Egg ("Eieröl").** — SCHAFER, F. and MEYER, L. (Laboratorium des Schweizer Gesundheitsamtes), in *Mitteilungen aus dem Gebiete der Lebensmitteluntersuchung und Hygiene*, Vol. IX, Part 2 and 3, pp. 135-136 + 1 Table, Berne, 1918.

There is little available data regarding the physical and chemical constants of the oily matter of the egg, *i. e.*, the oils extracted from the yellow of the fowl's egg by means of solvents. Recent determinations carried out by L. MEYER in the laboratory of the "Service Suisse de l'hygiène publique" were made with fresh eggs and eggs that had been stored a long time, using chloroform and petroleum ether as solvents. The results are summarised in table form, from which it appears that:—

1) The nature of the solvent has a marked influence on the value of these constants, as was observed by JEAN (*Ann. Chim. analyt.*, 53, 1903); while petroleum ether only extracts the oily matter, chloroform extracts the cholesterin and a part of the lecithins as well.

2) The differences found for the refractive and iodine indexes vary, even for products that have been stored a long time, between the limits stated in publications on the subject. The results obtained for the iodine value, to which LAVES gives the value 64 as the minimum, show a considerable variation, however, being 74 to 75 on an average.

3) The phosphorus pentoxide content of the lecithins diminishes gradually during storage, being 1.27 % for the fresh egg and 0.8 % after storage for 2 years.

918 - **The Relative Influence of Microorganisms and Plant Enzymes on the Fermentation of Maize Silage.** — LAMB, A. R. (Iowa Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. VIII, No. 10, pp. 361-380, 9 Tables, + 13 Diagrams + Bibliography of 27 Publications. Washington, D. C., March 6, 1917.

The question of the respective causal relationship of micro-organisms and plant cell enzymes to the fermentation of maize silage has long been in

AGRICULTURAL  
PRODUCTS:  
PRESERVING,  
PACKING,  
TRANSPORT,  
TRADE.

controversy. It is difficult to differentiate between the activities of these two kinds of agents. Work with antiseptics both by earlier investigators and by the writer is not conclusive. Experimental silage, other than antiseptic silage, has been made, with results of some value; but the most conclusive evidence was obtained by the determination of the rate of change in various phenomena of the fermentation under normal conditions. Curves plotted from these data show that bacteria are mainly responsible for acid production and the concomitant disappearance of sugars. Alcohol is formed first by plant enzymes and later by yeasts. Protein is hydrolysed first by enzymes and later by micro-organisms. Carbon dioxide evolution seems to be very largely due to respiratory or enzymic activities, but yeasts probably have a share in its production after the first day or two. Micro-organisms are probably largely responsible for the heating of the silage. Both kinds of factors are always present during silage fermentation and the process is due to the activities of both in the absence of air.

**919 - Changes in Composition of Sweet Potatoes left in the Ground when Mature.**

— See No. 851 of this *Review*.

**920 - The Influence of Salt on the Changes Taking Place in Storage Butter.** — WASHBURN, R. M. and DAHLBERG, A. C., in the *Journal of Dairy Science*. Vol. I, No. 2, pp. 114-126. Baltimore, July, 1917.

It is generally believed, and most experimental evidence supports this belief, that salt improves the keeping quality of butter. It has been observed; on the other hand, that unsalted butter in commercial cold storage keeps as well as or better than salted butter.

The experiment reported in this paper deals with this point and considers only salted versus unsalted butter. The butter was first held for the usual cold storage period in a commercial cold storage butter room and was then held for a short time at the usual ice box temperature. This latter treatment is comparable to that which commercially stored butter would receive before being consumed. At each scoring the usual bacteriological and chemical analyses were made so that probable causes of a possible difference would not be overlooked.

*Making, Storing, and Scoring the Butter.* — The cream used was sweet, clean cream of good flavour. It was ripened without pasteurisation on the addition of a starter to an average acidity of 0.58 per cent lactic acid. It churned in 20 to 30 minutes; the churning was stopped at the wheat kernel stage; the butter was washed twice, salted or not, and worked from 23 to 27 revolutions in a Victor double roller churn. Half the butter of each churning was salted and worked and the other half worked unsalted so that each sample of unsalted butter had an exact duplicate in the salted butter. It was then packed into 5 pound paraffined wooden butter drums lined with parchment paper. Enough of these containers were packed so that one from each lot could be taken out at every scoring. Initial data as to score, chemical and bacteriological analysis were obtained. The butter was stored in a commercial butter storage room in St. Paul, at a temperature of  $-15^{\circ}$  F. After 284 days in cold storage it was held for twenty days in a butter-cutting room at  $58^{\circ}$  to  $60^{\circ}$  F.

The following points were studied:—Influence of salt on score; influence of salt on bacterial activity; influence of salt on acidity; influence of salt on moisture, protein content; relation of score, acidity and bacteria in salted and unsalted butter. The following facts were brought out:—

Salt, exclusive of its antiseptic property, hastened the deterioration of the butter.

When stored at  $-15^{\circ}$  F. unsalted butter kept as well as salted butter.

The bacteria in the unsalted butter decreased more rapidly at  $-15^{\circ}$  F. than they did in the salted butter and increased more rapidly at  $58^{\circ}$  F.

The acidity of the unsalted and the salted butter increased uniformly at  $-15^{\circ}$  F, but at  $58^{\circ}$  F the increase was greater in the unsalted butter.

Moisture was lost from the salted butter, but not from the unsalted kept at  $-15^{\circ}$  F.

Little if any relationship existed between the bacteria, the acidity, and the score in this butter.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

#### GENERAL

921 - "Fucha" of the Cotton Plant, in the Department of Boyacá, Republic of Colombia. — PESTICO, J. F., in the *Revista Agrícola*, Year IV, No. 2, pp. 113-116 + 1 Fig. Bogotá, 1918. \*

Towards the middle of 1917 in the comarca of Miraflores, an eastern province of the department of Boyacá, the cotton plantations were attacked by a disease commonly known as "fucha", which, by stopping growth, destroys the greater part of the produce.

The disease is characterised by numerous small swellings on the leaves and young branches and also, more rarely, on the flowers. It usually becomes visible after prolonged rain and the diseased plant fades and dies one or two weeks later. Occasionally the plant survives but gives no crop.

Growers in the comarca of Miraflores consider cotton as an almost wild plant requiring no attention. Without any previous preparation of the soil they sow and await the harvest.

According to the author it is the lack of cultural methods which causes the appearance of the disease in question, which can only be overcome by radically reforming the present methods and replacing the variety of cotton now grown by others from strong and healthy plantations.

The lack of weeding allows a multitude of bushes to grow up round the cotton plants. These receive the abundant rain and the sun, and cause the formation of a hot, damp atmosphere, favourable to the development of swellings. On the other hand, cotton under such conditions is weak and incapable of assimilating the elements supplied by the soil. Chlorosis of the young branches increases and growth in general is weak.

To avoid the decadence of cotton-growing in the above-mentioned district there is a crying need for deep and repeated ploughing several weeks before sowing, for a careful selection of seed, continuous weeding, etc. It is also necessary to regulate the date of sowing so that the wet season will coincide with the growth of the plants and the dry season with the ripening of the bolls.

922 - The Mottling of Citrus Leaves in Relation to their Composition. — See No. 743 of the *Review* for July, 1918.

923 - "Möistad Grenader", a Norwegian Variety of Oat Resistant to Lodging. — See No. 855 of this *Review*.



- 924 - "Chasselas" × "Berlandieri 41 B" Vine Resistant to Bramble-leaf Disease.  
— See No 873 of this Review

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- 925 - Bacteria and Fungi Recorded as Parasitic on Cultivated Plants in the Province of Turin and Adjacent Regions in 1916 (1). — VOGLINO, P, in the *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LX (1917), pp. 205-229. Turin, 1918.

In this phytopathological review 110 bacteria and fungi are recorded as being the most harmful to cultivated plants in the province of Turin and the adjacent regions during 1916. The most important are given below.

1) A bacteriosis of the dwarf bean observed in market gardens at S. Bernardino (Trana); on many of the plants with pods nearly 2 in. long, the terminal leaves and consequently all the young buds, withered in a few days, while the leaves that were well developed turned yellow or mottled red; in the tissues of both buds and leaves there were colonies of bacteria identical with those observed previously in market gardens at Trana; it is recommended that infected plants should be at once burnt.

2) Peach bacteriosis, observed in the orchards at Vezza d'Alba near Canale and characterized by yellowing of the leaves, drying-up of the branches and the death of the plant; according to the author these phenomena are due to the formation of woody tumours of various sizes on the root system; a bacterium corresponding to *Bacterium tumefaciens* has been isolated from the tubers; this disease, which the author thinks is identical with "crown gall", appears to be spreading alarmingly.

In order to help in the defence against vine mildew the Phytopathological Observatory of Turin founded, in 1916, a service of "preventive detection" by means of a number of observatory Stations. Although 1916 was, on the whole, unfavourable for the disease, the first year's results of this Service are very satisfactory and show its absolute necessity as regards the indication of the exact period when the first treatments must be carried out against the parasite.

- 926 - Uredinales of the Andes, South America. — ARTHUR, J. C., in *The Botanical Gazette*, Vol. LXV, No. 5, pp. 460-474. Chicago, May, 1918.

This paper enumerates 25 species all, with the exception of four, collected by Dr. and Mrs. Rose on a journey taken in 1914 through the west of South America, particularly Peru and Chile. The list includes some species new to science, and some rare ones. Special mention should be made of:—

1) *Coleosporium Senecionis* (Pers.) Fries, collected on various species of *Senecio* in different parts of Chile and La Paz, Bolivia. It is remarkable that this rust, which is very common in Europe, is also abundant in Chile and, apparently, also in Argentina, whereas it is practically unknown in

(1) See R., July, 1917, No. 680. (Ed.)

North America. The aecidia occur on the leaves of pine. The fungus was collected at Providence, Rhode Island, in 1883 on *Senecio vulgaris*, but seems to have disappeared rapidly and was not reported again from any station in North America. No telia were found in any of the material examined. This shows that the aecidia on pine are rare or absent in that district, and that the rust is chiefly or wholly reproduced by uredospores.

2) *Puccinia Malvacearum* Mont., on *Malva sylvestris* and '*Malvas-trum capitatum*', in different parts of Chile. It is one of the commonest and best known rusts which, from its native country, the Andes, has spread to all parts of the world where *Malvaceae* grow.

3) *P. Nicotianae* n. sp. on *Nicotiana tomentosa* at Santa Clara, Peru.

4) *Uredo Erythroxylonis* Graz., on '*Erythroxylon Coca*', at La Paz; it is a common rust wherever this plant grows.

927 — ***Nezara viridula* and Kernel Spot of Pecan.** — TURNER, W. F., in *Science*, New Series, Vol. XLVII, No. 1220, pp. 490-492. Lancaster, Pa., May 17, 1918.

In 1914 RAND described *Coniothyrium caryogenum* as a cause of the infectious disease known as kernel spot of pecan (*Carya olivaeformis*). It attacks the seed, causing the formation of irregular dark brown or black spots, which are usually rather sunken. The discolouration sometimes extends to the interior of the kernel, which becomes bitter.

The disease seems to exist wherever pecan is grown, although, as a rule only a few of the kernels are attacked. Occasionally, however, as in 1916, it becomes of considerable economic importance, causing the loss of thousands of dollars to the growers.

*Nezara viridula* L. (1), commonly known as the green soldier bug, is found throughout middle and southern Georgia, where it occurs every year, occasionally, as in 1916, becoming very abundant. This insect appears to attack cow peas in preference to all wild or cultivated plants. In autumn, when the cow pea begins to dry up, the bugs leave them for any other plants or trees near.

Pecan growers commonly sow cow peas in the plantation in early summer to use it later as green manure. When, in September or early October, the plant begins to dry up the insects pass from it to the pecans.

In 1916 a serious invasion of *N. viridula* was reported, coinciding with a severe outbreak of kernel spot. Although it is possible that it was a mere coincidence, many growers observed that the disease only appeared to be serious in the plantations where cow pea had been grown. Moreover, in at least one case, the insects were observed feeding on the pecan nuts.

Preliminary experiments were, therefore, made, in which specimens of *N. viridula* taken from cow pea were placed on green pecan nuts, on which they fed, living on them for a month in three cases. An examination of the ripe nuts showed all those in the cages used during the experiment to be seriously attacked by kernel spot, as many as five distinct spots being found on one kernel. Of several hundred nuts from the same tree not confined in cages only two or three had spots.

(1) See R. March, 1917, No. 298. (Ed.).

It has not yet been possible to determine whether *Coniothyrium caryo-*  
*genum* is present in the spotted areas. In any case the data obtained point  
strongly to the fact that *N. viridula* is an important factor in producing or  
spreading the disease. This is of special interest because it is another of  
those observations, more and more frequent of recent years, of the economic  
importance of a large group of insects (several families of the Heteroptera,  
and, among the Homoptera, those of the *Cicadellidae* and *Aphididae*) as  
specific agents in various plant diseases, and as carriers and intermediaries  
in other diseases of bacterial or fungoid origin.

923 - Selected Indian Wheats Resistant to Rust and Lodging. — See No. 834 of this  
Review.

RESISTANT  
PLANTS

929 - Patents for the Control of Diseases and Pests of Plants. — See No. 899 of this Review.

MEANS  
OF PREVENTION  
AND CONTROL

930 - Diseases and Pests of the Sweet Potato in the Philippines. — See No. 864 of this  
Review.

931 - Experiments on the Action of Polysulphide Against Oidium of the Vine. —  
CAPUS, J., in *Revue de Viticulture*, Vol. XLVIII, No. 1251, pp. 393-394. Paris, 1918.

DISEASES  
OF VARIOUS  
CROPS

In 1917 the author made several experiments on the treatment of  
oidium with alkaline polysulphide, known commercially as "liver of sul-  
phur", applied in quantities of 500 gm. per hectolitre of water with 500 gm.  
of soft soap. Oidium attacks were not serious in Gironde in 1917, and in  
only two of the six vineyards in which the experiments were made was it  
possible to obtain clear and interesting results.

At the Chateau of Issan, at Cantenac in Médoc, the first application of  
polysulphide was made on June 30. The adjacent rows of both sides were  
treated with sulphur on the same day. The second application was on  
July 21. The adjacent rows were treated twice more with sulphur. The  
two polysulphide applications gave a protection as efficient as that of the  
three sulphur ones.

At Saint-Emilion, at Lamarzelle Chateau, two polysulphide treatments  
gave the same results as two sulphur treatments. This vineyard was in-  
fested with *Polychrosis botrana* which did much damage there in 1917.  
Polysulphide was applied for the second time during the first fortnight of  
July, at the time of the flight of the moths. On the clusters treated with  
polysulphide there were only half as many larvae as on those sprayed with  
sulphur.

In another experiment carried out at Saint-Sornin (Charente-Infé-  
rieure) lime-sulphur spray mixed with Bordeaux mixture was tried instead  
of polysulphide against oidium and mildew. The first results were satis-  
factory and the author intends continuing the experiment in 1918.

From a theoretical point of view alkaline polysulphide controls oidium.  
From a practical point of view, however, sulphur will always be preferred  
because:— 1) sulphur is always ready for use, whereas polysulphide must be  
dissolved; 2) sulphur is a fine powder and scatters more easily, penetrating  
better to the organ to be protected, *i. e.*, the fruit, than a liquid, especially  
in summer when the clusters are hidden by the leaves; 3) polysulphide may

injure the spraying machines, which are usually of copper, and must be carefully washed with fresh water after use.

Should the vine-grower have only an insufficient amount of sulphur he may use polysulphide only for the first treatments, to made before flowering. During this period it would have the following advantages:— 1) as the young bunches are not yet hidden by the leaves the liquid reaches them more easily; 2) at this time of year the temperature is not always sufficiently high to make the sulphur active; 3) as attacks of oidium have not yet begun the treatment is preventative; the sulphur being a powder, does not remain long on the leaves and is active only for a short time; 4) polysulphide may be applied at the same time as sulphur. More complete experiments will show whether, under these conditions, copper mixture is equally efficacious against mildew.

### WEEDS AND PARASITIC FLOWERING PLANTS.

932 - **Mexican Marigold (*Tagetes minuta*), a Weed in Rhodesia.** — EYLES, F., in *The Rhodesia Agricultural Journal*, Vol. XV, No. 2, pp. 153-154 + 2 Plates. Salisbury, Rhodesia, April, 1918.

In recent years Rhodesia has been invaded by a troublesome weed, *Tagetes minuta* L. (Compositae). It is generally known as Mexican Marigold, but is locally called Mexican Poppy, and, in Australia, Stinking Roger. It is a native of South America and believed to have been introduced into South Africa during the Boer War.

At the present time it is spreading with great rapidity in Rhodesia, both in waste and cultivated land and shows a marked preference for ant hills. Its root system is shallow and not very extensive, and it should be possible to destroy the plant or prevent its spreading. It succumbs to the usual methods of cultivation, but if its spread is to be checked it must be uprooted and killed while young, *i.e.*, before flowering, so that seed may not be formed.

The author has recently heard some farmers call this plant "Khaki Weed", which is an entirely different plant, *Alternanthera echinata* (fam. *Amarantaceae*), known in Rhodesia long before the Mexican Marigold first appeared. The confusion is probably caused by the fact that the Dutch call the Compositae "Khakibos".

### INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

#### GENERAL

933 - ***Aleyrodidae* Injurious to Various Plants in Different Countries (1).** — QUAIN-TANCE, A. L. and BAKER, A. C., in *Proceedings of the U. S. National Museum*, Vol. LI, No. 2156, pp. 335-445 + 10 Figs. + 46 Plats. Washington, 1917.

This paper is a continuation of the author's work on the classification of the *Aleyrodidae* based on material in the collections of the United States National Museum and the Bureau of Entomology, Washington.

(1) See R. Nov., 1916, No. 1241 (Ed.).

The following insects are described morphologically :—

- 1) *Aleurocanthus bambusae* (Peal), abundant on various species of *Bambusa* near Calcutta. Generally only a few leaves of a group of plants are attacked by the insect, but nevertheless it has been found in very large numbers in some bamboo clumps; in such cases it is a rather serious pest and often kills most of the leaves. The insect is controlled by a parasite, probably a chalcidid. When the insect is removed from the leaf the part beneath it is found to be yellow and discoloured.
- 2) *A. banksiae* (Maskell), living on *Banksia integrifolia* and *Callistemon linearis*, in Australia;
- 3) *A. calophylli* (Kotinsky), on *Calophyllum neophyllum*, at Levuka. (Fiji);
- 4) *A. citricolus* (Newstead), on *Citrus* sp., at Dares Salaam, German West Africa;
- 5) *A. citriperdus* Quaintance and Baker, on orange and an unknown tree in Java. Ceylon and India; apparently an abundant species;
- 6) *A. dissimilis* n. sp., on unknown vine, at Mirdon, Lower Burma;
- 7) *A. hirsutus* (Maskell), on *Acacia longifolia*, in Australia;
- 8) *A. longispinus* n. sp., on *Bambusa*, at Calcutta and Moulmein, Burma;
- 9) *A. mangiferae* n. sp., on mango, at Bombay, Saharanpur and Dehra Dun, India;
- 10) *A. nubilans* (Buckton), on leaves of *Piper Belle*, at Backergunge, India, where it did considerable damage;
- 11) *A. piperis* (Maskell), on *Piper nigrum* (?), in Ceylon;
- 12) *A. serratus* n. sp., on an unknown tree in the Botanical Gardens of Buitenzorg, Java;
- 13) *A. spiniferus* (Quaintance), on *Citrus* sp. and rose, at Garch, Java;
- 14) *A. spinosus* (Kuwana), on unknown host; found by KUWANA among Coccidae from Formosa;
- 15) *A. T-signatus* (Maskell), on *Acacia longifolia* near Sydney, Australia;
- 16) *A. woglumi* Ashby, a very common species in the east, recently introduced into the West Indies and Bahama Islands;
- 17) *A. voeltzkowii* (Newstead), on un-named plant, the leaves of which were almost entirely covered with the black puparia, larvae and eggs of the insect, at Sainte-Marie, Madagascar;
- 18) *Aleurocybotus graminicolus* (Quaintance);
- 19) *A. setiferus* n. sp., on *Imperata*, at Java, and on grass, at Peradeniya, Ceylon;
- 20) *Aleurolobus barodensis* (Maskell), on *Saccharum officinale*, at Baroda, India; reported as injurious;
- 21) *A. flavus* n. sp., on unknown tree in the Royal Botanic Gardens, Ceylon and on *Loranthus*, at Peradeniya;
- 22) *A. marlati* (Quaintance), on orange, at Hokato and Kumamoto, Japan;
- 23) *A. olivinus* (Silvestri), on olive in central and southern Italy;
- 24) *A. philippinensis* n. sp., on unknown tree and on *Murraya exotica*, at Manila, Philippines;
- 25) *A. setigerus* n. sp., on *Harpullia pendula* and on unknown host, at Peradeniya;
- 26) *A. simulus* (Peal), very abundant on *Bombax malabaricum* (Simul tree), in Calcutta; the leaves are thickly covered with the insect, become yellow or spotted where attacked and finally die;
- 27) *A. solitarius* n. sp., on *Cercis canadensis*, at Champaign, Illinois;
- 28) *A. taonabae* (Kuwana), on grapes at Okoga and on grapes and *Taonabo japonica* at Tokio;
- 29) *Aleuroparadoxus iridescens* (Bemis), on *Arctostaphylos* sp., near Camp Rincon, San Gabriel Mountains, California;
- 30) *A. punctatus* n. sp., on *Lithraea caustica* and *Quillaja Saponaria*, at Santiago, Chile;
- 31) *Aleuroplatus* (subgen. *Aleuroplatus*) *berbericulus* n. sp., on *Berberis Aquifolium*,

at Kaslo, British Columbia; the insect was also collected at Mexico City and on *Ilex*, at Toluca, Mexico;

32) *A. (Aleuroplatus) cockerelli* (Jhering);

33) *A. (Aleuroplatus) coccolus* n. sp., on coconut at Santiago de las Vegas, Cuba, and in Trinidad; on *Eugenia Michellii*, at Ceara, Brazil; has also been found in Panama;

34) *A. (Aleuroplatus) coronatus* (Quaintance), on *Quercus agrifoliae*, in Los Angeles, Pomona and Whittier, California, on unknown plant in San Bernardino, Calif., and on chestnut in Pasadena, California;

35) *A. euryae* (Kuwana);

36) *A. (Aleuroplatus) ficus-rugosae* n. sp., on *Ficus rugosa*, in the Royal Botanic Gardens of Calcutta;

37) *A. (Aleuroplatus) gelatinosus* (Cockerell);

38) *A. (Aleuroplatus) incisus* n. sp., on *Ostodes zeylanica*, *Garcinia spectabilis* and on an unknown tree in the Royal Botanical Gardens, Peradeniya;

39) *A. (Aleuroplatus) myricae* n. sp., on *Myrica* sp. (?), at Griffin, Georgia;

40) *A. (Aleuroplatus) oculiminutus* n. sp., on *Ficus* sp., in Trinidad;

41) *A. (Aleuroplatus) oculireniformis* n. sp., on *Passiflora*, at Ceara, Brazil;

42) *A. (Aleuroplatus) ovatus* n. sp., on *Berberis trifoliata*, at College Station, Texas;

43) *A. (Aleuroplatus) pectiniferus* n. sp., on *Morus* sp. and a *Euphorbiaceae*, at Lahore, India;

44) *A. (Aleuroplatus) plumosus* (Quaintance); was described from Florida; very abundant on cranberries, and collected on this plant at Cranmoor, Wisconsin, New-Egypt and Pemberton, New Jersey;

45) *A. (Aleuroplatus) quercus-aquaticae* (Quaintance);

46) *A. (Aleuroplatus) sculpturatus* n. sp., on *Heliconia*, Panama;

47) *A. (Aleuroplatus) translucidus* n. sp., on orange at Lahore and Wazirabad, India;

48) *A. (Aleuroplatus) validus* n. sp., on unknown host, at Hope, Kingston, Jamaica;

49) *A. (Aleuroplatus) variegatus* n. sp., on leaves of *Psidium* sp., at San José, Costa Rica;

50) *A. (Aleuroplatus) vinsonioides* (Cockerell), on *Nectandra*, at Matanzas, Cuba;

51) *A. (subgen. Orchamas) mammaeiferus* n. sp., on *Codiaeum variegatum*, in the Botanical Gardens at Buitenzorg;

52) *Aleurothrixus* (subgen. *Aleurothrixus*) *acpim* (Goeldi), on *Manihot utilisima*, at Rio de Janeiro;

53) *A. (Aleurothrixus) floccosus* (Maskell); this species was described for the first time on *Lignumvitae* from Jamaica, and later on guava from Brazil; it was reported on orange at Zapotlan, Mexico, but had previously been collected on the same plant at Laguna, Mexico; it is common in the West Indies, and is also found in Florida, British Guiana, Argentina, Chile, Paraguay, and Costa Rica; besides *Citrus* spp. it has been found on *Coccoloba uvifera* (sea grape), *Plumeria* sp., *Baccharis genistelloides*, a coarse grass, and a climbing vine;

54) *A. (Aleurothrixus) howardi* (Quaintance), on the same hosts and in the same localities as the preceding species; reported for the first time in the United States on sea grape at Miami, Florida;

55) *A. (Aleurothrixus) porteri* (Quaintance and Baker), common on citrus in Chile;

56) *A. (subgen. Philodamus) interrogatoris* (Bemis);

57) *Dialeurodes* (subgen. *Dialeurodes*) *citri* (Ashmead), known as the orange white fly, is found on orange in the following States of the United States: Alabama, California, Colorado, Florida, Illinois, Louisiana, Mississippi, North Carolina, Texas, and District of Columbia; specimens have also been received from India (Lahore, Gujranwala, Dehra Dun, Wazirabad, Amritsar, Khasia Hills, Assam, Saharanpur), Japan (Nagasaki), and China (Canton, Peking, Shanghai); the insect also occurs in Chile, Mexico, and Brazil;

58) *D. (Dialeurodes) citrifolii* (Morgan) on orange in the following States: — Florida,

California, Louisiana, Mississippi, and North Carolina; the species is also known from Mexico and Cuba;

59) *D. (Dialeurodes) rodens* (Maskell), on *Drimys axillaris*, in New Zealand;

60) *D. (Dialeurodes) kirkalayi* (Kotinsky), on leaves of *Jasminum* at Georgetown, Demerara, British Guiana;

61) *D. (Dialeurodes) radiipuncta* n. sp., in Ceylon;

62) *D. (Dialeurodes) tricolor* n. sp., on leaves of a myrtaceous plant at Rubato, Brazil;

63) *D.* (subgen. *Rusostigma*) *eugeniae* (Maskell), on *Eugenia jambolana*, in India;

64) *D. (Rusostigma) radirugosa* n. sp., on mango, in Brilliton Is., Dutch East Indies and on a woody shrub at Gercit, Java;

65) *D. (Rusostigma) tokyonis* (Kuwana), on *Ilex integra*, in the locality Shibuya, Tokyo;

66) *D.* (subgen. *Dialeuonemada*) *dissimilis* n. sp., on *Phyllanthus myrsinifolius* at Saharanpur, India;

67) *D.* (subgen. *Rabdostigma*) *radulmealis* n. sp., on mistletoe, at New Ava Eliya, Ceylon;

68) *D.* (subgen. *Gigaleurodes*) *cerifera* n. sp., on *Celastrus buxifolius*, at Cape Town, South Africa;

69) *D. (Gigaleurodes) busckii* n. sp., on leaves of a climbing vine, at Bayamon, Porto Rico;

70) *D. (Gigaleurodes) maxima* n. sp., on *Ficus* sp., at Manila, Philippines;

71) *D. (Gigaleurodes) struthanthi* (Hempell), on *Struthanthus flexicaulis*, orange, *Melichia flava* and unidentified forest tree at Parnahyba and São Paulo, Brazil;

72) *S.* (subgen. *Rachisphora*) *fijiensis* (Kotinsky), on leaves and fruit of a Leguminosae at Rewa, Fiji;

73) *D. (Rachisphora) rutherfordi* n. sp., on *Loranthus*, at Peradeniya, Ceylon;

74) *D. (Rachisphora) trilobitoides* n. sp., on *Harpullia* and *Eugenia operculata*, at Peradeniya, on an unknown plant in the Royal Botanical Gardens, Ceylon;

75) *S.* (subgen. *Dialeuropora*) *decompuncta* n. sp., on *Cinnamomum*, in the Royal Botanical Gardens, Ceylon, and on mulberry, at Lahore, India;

76) *D.* (subgen. *Dialeuroplata*) *townsendi* n. sp., on a fern at Lucerna, Tayabas, Philippines;

77) *Neomaskellia comata* (Maskell);

78) *N. bergii* (Signoret), on unknown host in Java, and on a wild grass at Manila.

934 - West Indian and North American Chalcids. — GIRAULT, A. A., in *Entomological News*, Vol. XXIX, No. 4, pp. 125-131. Philadelphia, April, 1918.

The following should be noted: —

1) *Grotiusomyia nigricans* (Howard); one female reared from a larva of *Eudamus proteus* in St. Vincent, British West Indies.

2) *Gr. flavicornis* Girault; two females reared from a pyralid leaf-miner on oat at Washington, D. C.

3) *Polycystus clypeatus* n. sp.; one female reared from a leaf-miner on maize in St. Vincent.

4) *Sycophila incerta* Ashmead; many females reared from *Ficus laurina*, Barbados, West Indies.

5) *Indarnes carme* Walker, reared with a *Blastophaga* from *F. laurina* in Barbados.

6) *Pseudomphale eudami* n. sp.; reared from the larva of *Eudamus proteus* in St. Vincent.

7) *Closterocerus utahensis* Crawford (*Cl. californicus* Girault); one female from *Symydobius chrysolepis*, on *Quercus chrysolepis*, in California.

8) *Omphalchrysocharis petiolatus* n. sp.; reared from an oscinid on a daisy, at Washington, D. C.

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9) *Arthrolytus aeneoviridis* Girault; one female from *Bucculatrix thurberiaella*, on cotton at Phoenix, Arizona.

935 - *Ipoobracon saccharalis* n. sp. and *Microdus diatraeae*, Hymenoptera Parasitic on *Diatraea saccharalis*, a Microlepidopteron Injurious to Sugar Canes, in British Guiana. — TURNER, R. E., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 1, pp. 81-82. London, May, 1918.

Three species of Braconidae have been bred in British Guiana from the larva of *Diatraea saccharalis* (1) :—

1) *Ipoobracon grenadensis* Ashm., previously mentioned by the author (1917) ;

2) *I. saccharalis* n. sp., a parasite of the larva of *Diatraea*, in the Non Pareil Plantation, East Coast of Demerara ;

3) *Microdus diatraeae* n. sp., a parasite of the larva of the same microlepidopteron, at Lusignan, Non Pareil and Ogle plantations, East Coast of Demerara.

A morphological description of both of these two last species is given.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

936 - Weevils Which Affect the Potato, Sweet Potato, and Yam. — PIERCE, W. D., in the *Journal of Agricultural Research*, Vol. XII, No. 9, pp. 601-612 + 7 Plates. Washington, March 4, 1918.

In 1914 the author reported three weevils observed in South America as important pests of the potato tuber. In the paper under review he enumerates the three weevils previously studied, describes a fourth which also attacks the potato, gives notes on the morphology of four other weevils injurious to sweet potato (*Ipomoea Batatas*) tubers and of another described as a new pest of tubers of the yam (*Dioscorea Batatas*)

WEEVILS WHICH ATTACK IRISH POTATO TUBERS : — 1) *Rhigopsidius tucumanus* Heller, reported by the author in 1914 in the following localities : Tucumán, Argentina ; Cuzco, Temuco, and Arequipa, Peru ; Oruro, Bolivia ; Ancud or San Carlos and Castro Islands, Chile.

2) *Premnotrypes solani* Pierce (1914) in the mountain districts of Peru.

3) *Trypopermon latithorax* Pierce (1914), described as a pest of tubers, from Cuzco ; on June 11, 1914, Mr. H. L. SANFORD found numerous larvae of this species in potatoes from La Paz, Bolivia ; the transformation of the larvae into pupae was noticed from June 20 to 26, and an adult emerged on June 26 ; this enabled the author to describe the larva and pupa.

4) *Tryp. sanfordi* n. sp., described from a single specimen collected by Mr. SANFORD on September 24, 1915, from a potato from Cuzco.

WEEVILS WHICH ATTACK SWEET POTATO TUBERS (2). — 1) *Cylas formicarius* Fabricius var. *elegantulus* Summers ; the author gives this name temporarily to the common sweet potato weevil with blueish elytra, red thorax and legs, and black head ; the larva and pupa are described from specimens taken at Victoria, Texas ; the figures of the male are drawn

(1) See R April, 1916, No. 479 (Ed.) — (2) See R., May, 1918, No. 607. (Ed.)



partly from a New Orleans, Louisiana, specimen, partly from a Honolulu, Hawaiian Islands, one; specimens found at Victoria were used for the figures of the larva and pupa.

2) *C. turcipennis* Boheman; two specimens from Palembang, Sumatra, and two from Bay Laguna Province, Philippine Islands, are considered as belonging to this species; an adult was found in Guatemala; the insect was observed by PASCOE at Sarawak, Java and in India.

3) *C. femoralis* Faust, collected from February to April, 1897, on Mount Coffee, Liberia, where it did serious damage; it has also been reported from Kamerun.

4) *Euscepes batatae* C. O. Waterhouse (Scarabee of the Sweet Potato); one of the most serious cosmopolitan pests of the sweet potato, though up to the present it has only been reported from Barbados, St. Vincent, Antigua, St. Kitts, Nevis and Hawaii; having received from Brazil two specimens of this weevil with the statement that they attacked sweet potatoes at Rio de Janeiro, the author undertook research through the undetermined collections of the U. S. National Museum and was thus able to ascertain the existence of the insect in Barbados, Jamaica (Hope, Kingston), Brazil (Campinas, Rio de Janeiro), Hawaii (Honolulu, Kaimuki, Oahu), Guam, Norfolk Island near New Zealand, and Porto Rico (Mayaguez); the wide geographical distribution of the insect makes it appear probable that it is found in many other districts where the sweet potato is grown; a description of the adult, larva and pupa is given; material from Hawaii has been used for the figures of the adult, material from Barbados for those of the larva and pupa.

WEEVIL WHICH ATTACKS THE YAM TUBER. — *Palaeopus dioscoreae* n. sp.; described from two specimens reared from the tubers of yams from Jamaica (Hope, Kingston).

937 - *Physothrips marshalli* n. sp., a Thrips Observed on Potato and Other Plants in the Gold Coast. — BAGNALL, R. S., in the *Bulletin of Entomological Research*, Vol. IX, Pt. I, pp. 65-70 + 3 Figs. London, May, 1918.

The author describes particularly as a species new to science under the name of *Physothrips marshalli* a thrips collected at Aburi, Gold Coast, where it appears to be common.

Females only were found in flowers of *Solanum tuberosum* and *S. Wendlandii*; both sexes, but chiefly females, in flowers of *Ipomoeae Bona-nox*; both sexes with fairly plentiful males, in flowers of *Hibiscus sinensis*, *Thunbergia erecta*, *T. laurifolia*, *Strophanthus gratus* and *Canna*.

Morphological notes are also given on two previously described species, *Phys. funtumiae* Bagn. (1913), and *Phys. kellyanus* Bagn. (1916), the first of which forms the type of a small group of the genus *Physothrips* which includes the two species mentioned above.

*Phys. funtumiae* lives on *Funtumia elastica* and is known in Uganda and Southern Nigeria. *Phys. kellyanus* was described from specimens collected in North Queensland on a composite plant (*Helianthus* sp. ?), and on a South African plant (*Acokanthera spectabilis*) in the Botanic Gardens of

Brisbane,<sup>1</sup> Queensland. The insect has also been found in Victoria on *Hypochoeris radicata*.

938 - **Damage Caused to the Cotton Plant in Algeria by *Gelechia gossypiella*.** — See No. 865 of this *Review*.

939 - **The Sugar-Cane Froghopper in Grenada, Lesser Antilles.** — WILLIAMS, C. B., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 1, pp. 83-87 + Map. London, May, 1918.

During investigations carried out on behalf of the Government of Trinidad on froghoppers (*Cercopidae*) of the genus *Tomaspis* found on sugar cane in that and the neighbouring islands (1), the author stayed a few days in December, 1916, at Grenada to study a small but serious attack of froghoppers there.

The insects were first reported from Grenada by UHLER in 1895, under the name of *T. pictipennis* Stål. In 1912 several specimens found on Para grass (*Panicum barbinode*) were sent from Grenada to the Board of Agriculture at Trinidad. URICH believed these to belong to the same species as that recorded by UHLER; it was, however, not *T. pictipennis*, but a species very similar to that of Trinidad, *T. saccharina* Distant, then known as *T. varia* Fabr. Urich nevertheless believed the Grenada specimens to be distinct from the Trinidad species. At the beginning of December, 1916, froghoppers were reported to be doing serious damage to sugar cane in one part of Grenada.

Froghoppers of one species were found widely distributed in the Island on grass in cane-fields, on the roadside, and also on sugar cane. The author did not visit the north-east of the Island, but it is probable that froghoppers are there too. Their wide distribution shows that they have long been established at Grenada.

The damage was reported from Mount Horne and Nainganfoix. The author visited the first locality and found the principal characteristics of the froghopper attack were quite similar to those found in Trinidad.

A careful comparison of the numerous specimens of the insect found in Grenada and the Trinidad species led the author to conclude that in both cases the insect was *T. saccharina* Distant. This is the first certain record of this insect outside Trinidad.

With regard to the natural enemies of the hemipteron (2), no larvae of the Trinidad Syrphid fly (*Salpingogaster nigra*) (3) were found at Grenada, and if present they must be too rare to have any effect in the control of the insect.

A single dead adult froghopper was found to be infected with *Metarhizium Anisopliae* (4), but this is also too rare to be of any practical use.

(1) See B. Dec., 1910, p. 421; B. Jan., 1911, No. 352; B. Feb. 1911, No. 649; B. May, 1911, Nos. 1558 and 1584, B. Dec., 1912, No. 1698; B. June, 1914, No. 549. (Ed.) —

(2) See B. Nov., 1910, p. 186; B. Feb., 1911, No. 650; B. Dec., 1912, No. 1698; B. Nov., 1913, No. 1306; B. Feb., 1914, No. 188. (Ed.) — (3) See B. Feb., 1914, No. 188. (Ed.) —

(4) See B. Feb., 1911, No. 650; B. Dec., 1912, No. 1698 (Ed.).

Attid spiders, an important control in Trinidad, were very scarce on the canes at Grenada.

Some specimens of the predatory grasshopper (*Xiphidium fasciatum*) known to feed on froghoppers were found in the grass near infested cane fields as well as in other parts of Grenada. It does not, however, appear actually to enter the plantations, but may help to keep down the froghoppers in the areas between, and so prevent a rapid spread of the insect.

The mongoose (mammal belonging to the genus *Herpestes*), which is indirectly partly responsible for the damage done by the insects because of the birds and lizards it destroys, is generally common in Grenada, and in some localities rewards are offered for its destruction.

The author spread over the infested fields in Grenada a mixture, prepared at Trinidad, composed of artificial cultures of *Metarrhizium* spores and rice flour, in the hope of infecting the froghoppers. After leaving Grenada he was informed that several dead infected grasshoppers were observed at Mount Horne, and that in 1917 the insects again appeared in the fields he had visited, but not to the same extent as in the previous year.

*T. saccharina* was found in the following localities of Grenada : St. George, Belmont, on grass among cane ; Morne Rouge, on cane ; St. George Lower Road, on grass ; Woodlands and Calvini, on cane ; St. Davids ; North of Barley's Bacolet, on grass ; La Sagesse, on grass ; St. Andrew, Meneve, Simon, St. Andrew Harbour, on grass ; Lower Simon, Mount Horne, Nain-ganfoix, on cane ; St. Patrick ; St. Mark and St. John were not visited by the author, but there is no doubt that the insect also exists there.

940 - **Hemiptera Living on Cultivated Plants in the Belgian Congo.** — DISTANT, W. L., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 1, pp. 71-73 + 3 Figs. London, May, 1918.

The author describes the following species of hemiptera (fam. *Capsidae*) :—

1) *Lycidocoris mimeticus* Reut. and Popp. : Var. A. (typical form) was found at Lubowa, Uganda ; Var. B. was found on coffee bushes at Eala, Belgian Congo ;

2) *Lyc. modestus* n. sp., on *Cinchona*, at Eala ;

3) *Lyc. thoracicus* n. sp., on indigenous rubiaceous plant, at Eala ;

4) *Chamus beltus* n. sp., on " lionzi " at Eala ;

5) *Ch. tuberculatus* n. sp., on *Psidium Guajava* at Kunnulû, Belgian Congo.

941 - ***Physothrips setiventris* n. sp. and *Phys. lefroyi*, Thrips Injurious to Tea in India.** — BAGNALL, R. S., in the *Bulletin of Entomological Research*, Vol. IX, Pt. 1, pp. 61-64 + 2 Figs. London, May, 1918.

A description is given of the two following species found in India on tea in such numbers that they may be regarded as pests :—

1) *Physothrips setiventris* n. sp., collected on tea at Ringon, T. E., Darjiling district, in June, 1916 ; females were taken on the same host plant at Lebong, in September, 1908 ;

2) *Phys. lefroyi* Bagnall, observed on flowers of tea at Lebong, in February, 1909.

942 - Pests Observed on Tobacco from Réunion Grown in Mauritius. — AUCHINCLECK, G. G., in *Department of Agriculture, Mauritius, General Series, Bulletin No 9*, pp. 6. Port Louis, 1917.

In 1916 to 1917 cultural experiments were made in Mauritius with a variety of tobacco widely grown in the neighbouring island of Réunion under the name of "tabac bleu". Its produce (scaferlati) is imported into Mauritius in large quantities and is largely consumed there. The experiments gave good results, but the plant suffered from insect and fungoid pests.

In the first stages of development the plants on the borders of the plot cultivated at Pamplemousses were seriously attacked by *Achatina ponderosa*. The molluscs were collected by hand and destroyed. To keep the pest away till the tobacco-plants were sufficiently strong lime was spread around them.

The young plants were slightly damaged by larvae of *Heliothis armigera*, which was controlled by collecting it by hand.

Young seedlings are subject to attack from *Pythium de Baryanum* if planted too close. This may be prevented by spreading ashes round the seedlings and thinning out the young plants.

Ants are particularly fond of the seeds. To protect the seedlings against these insects they should be surrounded by a border of earth moistened with paraffin.

The most serious damage was due to a disease of the roots, an anguillulid (*Heterodera*), and a fungus producing spots on the leaves. Steps must be taken in the future to control all these three causes of disease. The disease of the roots, probably due to a *Fusarium*, invaded the small plantation at Beau Bassin. Several plants were killed by the fungus, which, it seems, may be controlled by spreading lime abundantly over the soil and by isolating the infected plot by a trench.

The anguillulid appeared in the Pamplemousses plantation and in a small plot at Réduit. The growth of the plants attacked was arrested, and they turned pale and sickly looking. Some parts of Mauritius seem seriously infested by this worm, and it is doubtful whether tobacco could do well there.

The spots on the leaves are caused by a fungus (*Erysiphe*). Small, round, reddish-brown spots occur on the mature leaves. At Pamplemousses in 1915 the Turkish tobacco suffered severely from this disease, many of the plants being quite unusable. The "tabac bleu" variety remained immune till the plants were fully ripe, and was then attacked, but only slightly. In a wet year, however, the damage might be very serious seeing that badly spotted leaves reduce the value of the tobacco. Moreover, in the case of tobacco, a disease of the leaves is very difficult to treat because anti-cryptogamic sprays would injure the quality of leaves to be used for smoking.

943 - *Agriolimax agrestis*. A Molluscan Garden Pest, in New York State. — BAKER, F. C., in *Science*, New Series, Vol. XLVII, No. 1216, pp. 391-392. Lancaster, Pa., April 19, 1918.

The author previously reported the presence of this slug in market gardens in New York State, where it had done considerable damage to

cauliflowers, lettuces, and potatoes (1). In the summer and early autumn of 1917 the slug became still more troublesome.

At Brewerton it was observed eating cabbages and potatoes; in Syracuse it attacked potatoes, doing much injury in several fields and gardens. In one garden potatoes were so severely attacked that two-thirds of the tubers were destroyed. Several slugs were found in a single potato together with many larvae of a beetle (probably *Agriotus manicus* Say) and isopods. The larvae of the coleopteron were reported as very abundant in potatoes in Syracuse and Rochester, and damage by the slug was reported from Rochester, Canandaigua and Geneva.

It is obvious that the slug is becoming a pest in market gardens and that it must be controlled; when its action is limited to the epigeal parts of the plant this may be done by spreading fine ash round the plant; the copious flow of mucus caused by the irritating action of the ash exhausts the slug. This method, however, is not effective if the soil is penetrated and the tuber attacked below the surface. If the grass round the garden were kept short it would not be possible for the slug to hide there during the day, for it is only active at night. Boards placed round the garden may also be used as traps; during the day the slugs hide under them and may be collected and killed.

*A. agrestis* is one of the most common slugs in western New York,

It is interesting to note that a related species, *A. campestris* Binney, has been observed eating considerable numbers of plant lice (*Phorodon mahaleb* Fonsc.); thus, unlike *A. agrestis*, this is a useful species.

944 - *Stephanitis rhododendri*, Injurious to Rhododendrons, in France. — MARCHAL, P. in the *Bulletin de la Société de Pathologie végétale de France*, Vol IV, Pt. 2, pp 93-95. Paris, 1917.

The presence of a new pest of ornamental trees was observed in the neighbourhood of Paris in 1917. The pest, a hemipteron of the Tingitidae family (Hemiptera-Heteroptera), *Stephanitis rhododendri* Horv., was discovered in nurseries at Châtenay (Seine) and has since been observed at Versailles.

According to information from Versailles the insect was introduced on rhododendron trees imported from Holland tree or four years ago. It was in Holland, in the Boskoop nurseries, that *Steph. rhododendri* was first observed, and HORVATH described it in 1905 from samples collected there. In spite of all attempts to destroy it the insect has persisted in this locality and spread into the neighbouring district. In 1910 it was also reported from England by DISTANT, who believes it to have been introduced into Europe from the Indies, though the name by which it is known in Holland, "japansche luis", implies that it might have been imported from Japan.

The damage done by *Steph. rhododendri*, chiefly in June and July, is similar to that done by *Steph. pyri* Fabr. Certain varieties of rhododendron suffer much more than others. According to RITZEMA BOS the eggs are

(1) See B. May, 1916, No. 600. (Ed.)

laid towards the end of July or the beginning of August on the thick part of the under surface of the leaf, near the main vein. The eggs hibernate and hatch in spring. After three months the wings of the insect are fully developed, thus enabling it to emigrate to other plants. In Holland at least there is only one generation a year.

The best means of controlling the insect is by spraying with nicotine, soap, or pyrethrum, which must be applied so as to reach the under surface of the leaf. The soil must be turned with a spade after the treatment, which should be applied frequently early in spring, before the wings of the insect have developed. In Holland "X. L. All." insecticide is most used, or else a nicotine solution mixed with 2 % soap and 1 % spirit.

Fumigations with tobacco under a cloth arranged as a tent may also be recommended. Where there is a staff accustomed to fumigation with hydrocyanic acid there is little doubt that this method would give the best results.

To prevent the spreading of the insect, care must be taken to use only healthy plants as stock and to examine young plants when transplanting them, carefully picking and burning all leaves attacked by the insect.

945—*Cecidomyid Flies Living on Olea chrysophylla and O. europaea, in Eritrea and Italy Respectively.*—DEL GUERCIO, in *L'Agricoltura Coloniale*, Year XII, 1st. Half-Year, No. 2, pp. 65-102 + 35 Figs. Florence, 1918.

A morpho-biological description is given of the larvae and in two cases, also the pupae, of several diptera belonging to the *Cecidomyiidae* family which live on *Olea chrysophylla* in Eritrea and *O. europaea* in Italy. The injury done by the larvae to the respective host plants is also described. The determination of the diptera—described as species new to science—is based, in the absence of adults, on the characters of the larvae examined.

1) *Rhabdophaga oleiperda* n. sp.; attacks young branches of *O. chrysophylla*. The branches are deformed by the galls caused by the larvae, their growth stops, their leaves drop, and eventually they die. If death does not occur the branches remain sterile. The pupa is described. The larva is attacked by an ectoparasitic chalcid, which seems very valuable in the natural control of this insect.

2) *Hormomyia oleiphila* n. sp. The galls produced by the larva develop on the leaves of *O. chrysophylla* and, more rarely, on the extremity of the petiole. The growth of the leaves is stopped, or is so limited that they hardly surround the diseased part with a small border of blade, or the leaf is reduced merely to the portion occupied by the gall. The leaf surface is thus reduced with corresponding injury to the vegetative system and a relative decrease in the yield of the plant. The pupa of this dipteran is also known. The larva may be controlled effectively with an ectoparasitic chalcid.

3) *Radulella aureocephala* n. sp. The larva of this insect causes the formation of very prominent galls on both sides of the leaves of *O. chrysophylla*. It does not appear to be as important as the two preceding insects, especially the first.

4) *Ferrisia chrysophyllae* n. sp. Leaf galls are formed on *O. chry-*

*sophylla*. In economic importance this insect comes after *Rhabdophaga oleiperda*; to judge by the few leaves examined by the author, when they are attacked they are reduced to about half their normal size.

5) *P. proxima* n. sp. Leaf galls are formed on *O. chrysophylla* causing a marked reduction of the leaves attacked; this reduction is less marked when the petiole is diseased. The economic importance of the insect is equal to that of the preceding one.

6) *P. verrucosa* n. sp. The leaf galls formed on *O. chrysophylla* are similar to those caused by *P. proxima*.

7) *Lasioptera carpophila* n. sp. The larva is described from a specimen found in fruit of *O. europaea* from the province of Teramo. A larva probably identical with the preceding one has been observed in olives from Promontorio Garganico.

The author takes *Dasineura lathierei* and *Lasioptera kiefferiana*, which in Italy attack the vegetative and reproductive organs of *O. europaea*, as types of two new genera which he calls *Gioliella lathierei* and *Gastinella kiefferiana* respectively.

The most important preventative control measure for some of these insects is to prevent their passing from one continent or district to another in attacked produce. Although it has not yet been proved experimentally that *Rhabd. oleiperda*, peculiar to *O. chrysophylla*, can also attack the common olive, the mere possibility is sufficient to justify the above precaution until the contrary has been proved. The same applies to *Gioliella lathierei* and *Gastinella kiefferiana*, so that they may not be carried from Lake Major and the unredeemed lands to central and southern Italy.

When the species of diptera described are already very common, the easiest, best, and most economical way of preventing their spreading and to cure attacked plants is by suitable pruning or topping of the diseased branches. All the parts cut should be immediately burnt. As topping prevents harvest in the year in which it is carried out it is best to prune, whether the plants be small or fairly large, and to spray abundantly with lime water, calcium polysulphide, or lime sulphur mixture, using these liquids alone, or, better still, together with a certain amount of flour, even if damaged, as it makes the mixture more adhesive.

946 - *Hoplia floridana* n. sp., a Coleopteron Injurious to Citrus, in Florida. — FISHER, W. S., in *The Canadian Entomologist*, Vol. L, No. 4, pp. 140-142. London, April, 1918.

Under the name of *Hoplia floridana* a description is given of a coleopteron (fam. Scarabaeidae) collected at Lake Wales, Florida, by Mr. H. L. DOZIER on February 7, 1917; it is described as new to science. The five specimens, two males and three females, found up to the present were taken while feeding on citrus foliage.

947 - *Nezara viridula*, a Hemipteron Injurious to Pecan Trees in Georgia, U. S. A. — See No. 927 of this Review.

948 - *Evetria buoliana*, a Microlepidopteron Injurious to Pines in France — LÉVÊQUE DE VILMORIN, PH., in the *Bulletin de la Société de Pathologie végétale de France*, Vol. IV, Pt. 2, pp. 83-85. Paris, 1917.

For many years the pines of Verrières have suffered from attacks of *Evetria buoliana* Schiff., which destroys a considerable number of buds and deforms the trees to such an extent that they are absolutely unrecognizable. Young trees are particularly attacked.

The microlepidopteron (fam. *Tortricidae*) was described for the first time in 1776, in Austria, and is known in Europe, where, of recent years, notes on it have been published by various authors, amongst them BARBEY, LESNE and TRINCHIERI.

In the summer of 1914 it was reported for the first time in different parts of the United States, where it was probably introduced accidentally on young pines imported from Europe. In order to prevent its being again introduced, the American Government, by its Quarantine Order No. 20 of March 1, 1915, which came into force on July 1, 1915, forbade the importation of all varieties of pine of European origin.

At Verrières *P. ponderosa*, *P. ponderosa* var. *Malletii*, *P. Sabiniana*, *P. Taeda*, *P. contorta*, *P. muricata* are seriously injured, and some specimens have been completely killed by the repeated attacks of the insect.

*P. Thunbergii*, *P. Wilsonii*, *P. Coulteri*, *P. Jeffreyi*, *P. yunnanensis*, *P. uncinata*, *P. Balfouriana*, *P. Pinaster*, *P. monophylla*, *P. leiophylla* and many others are also attacked, but less severely.

The only specimens of *P. sylvestris*, *P. Laricio* and *P. Laricio* var. *aus-triaca* are old and strong, and the damage could not be ascertained.

On the other hand, a series of 5-leaved pines, represented at Verrières by *P. Armandi*, *P. Ayacahuite*, *P. Cembra*, *P. excelsa*, *P. koraiensis*, *P. monticola*, *P. parviflora*, *P. pentaphylla*, *P. Peuce* and *P. Strobis* has, so far, proved immune.

The fine pine from northern China, *P. Bungeana*, is also free from attack, as is a fairly strong specimen of *P. sylvestris* var. *rigensis*, and another of *P. rigida*.

The insect pupates in a gallery hollowed within the bud, in the first fortnight of June, and the moths appear at the end of June or beginning of July. Attacked buds which were placed in a breeding cage on June 1, 1915, gave moths on June 5. In 1917, nearly all the larvae pupated on June 11, and the first moths emerged on June 26. The author found a parasitised pupa, the body of which was filled with a large number of small larvae.

The only method of control seems to be the collection and destruction of infected buds containing larvae or pupae. Nevertheless, although this method has been adopted carefully for many years at Verrières, the ravages of the insect continue to increase. It might be possible to utilise several species of ichneumons, parasites of the larvae of *Evetria*, the presence of which was first observed in 1917 at Verrières. M. LESNE advises that attacked buds should be collected towards the beginning of June, and that, instead of burning them, they should be enclosed in vessels covered



with a fine mesh metallic net which will prevent the escape of the moths, but not that of their parasites.

### INJURIOUS VERTEBRATES.

949—**The Control of Field Mice by Acetylene Gas.**—ΠΑΠΑΓΕΩΡΓΙΟΥ ΠΗΔ.  
(PAPAGEORGIOU, P.) in ΓΕΩΡΓΙΚΟΝ ΔΕΔΤΙΟΝ ΤΗΣ Β. ΓΕΩΡΙΚΗΣ  
ΕΤΑΙΡΕΙΑΣ (*Bulletin of the Royal Hellenic Society of Agriculture*), Vol. X, No. III,  
pp. 3179-3182 + 1 Fig. Athens, 1918.

The author reports the very satisfactory results obtained by him at the Agricultural Station of Thessaly with a new acetylene gas method for destroying field mice. In many parts of the vast cereal-producing plain of Thessaly field mice, aided by favourable conditions, have multiplied so considerably that they are a serious menace to the coming harvest. In the absence of other chemical products, such as strychnine, carbon bisulphide, etc, the author applied calcium carbide, produced in large quantities by a local firm working a water fall at Gorgopotamos, near Lamia. Small pieces of calcium carbide the size of a pea are placed in the holes dug by the mice, a little water poured in and the holes stopped up. The mice are suffocated by the gas. If new holes open in two or three days the procedure is repeated. The method is harmless to those using it, easy to apply, and cheap.

[948.949]



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INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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**INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE**  
MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

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FIRST PART.  
ORIGINAL ARTICLES

---

**Mechanical Ploughing.**

**Methods of Ploughing without Ridges**

by

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of the "R. Stazione Sperimentale di Riscoltura" at Vercelle, Italy.*

The most important factors controlling the yield from a machine plough are the way the land is set out and the choice of the most suitable method of ploughing.

As is well known there are two systems of ploughing — ploughing with or without ridges (1).

PLOUGHING WITHOUT RIDGES.

In this method the furrow-slices are turned always to one side and no open furrows are left, thus facilitating work with harrows, drills, binders, etc., but requiring good well-drained soil. It can be performed in two ways:—

1) The *ordinary method* (the most used in Europe) consists in successively turning parallel furrows, by moving backwards and forwards be-

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(1) Hilling-up (used for maize and other hoed crops) can be considered as a derivation of both the above-mentioned systems, rather than as a special method, as it first requires the land to be worked uniformly, the hills being thrown up afterwards, usually with double-breasted ploughs

tween the headlands. It is also practised on hilly land, as the furrows can all be thrown down-hill. It requires ploughs that can alternately turn the soil to the right (going) and left (returning) as with one-way, balance, and double Brabant ploughs.

2) *The Felleberg method* requires uninterrupted furrows, obtained by keeping the plough turning continually in the field, either from the headlands towards the centre or vice versa. With this method there are thus curved furrows at the corners of the field, therefore leaving small triangular areas unploughed. It evidently necessitates the use of the common single-breasted plough (turning either to the right or left) as in the ordinary motor- or traction-ploughs.

The same type of plough can be used for making ridges, either by gathering-up or casting. This method is too well known to necessitate a description, but, on account of its importance, it will be considered later.

1) **ORDINARY PLOUGHING WITHOUT RIDGES.** — This can be done on land of any shape or size and requires no special setting-out of the land, but the following precautions should be observed: —

a) The furrows should be turned parallel to the longest side of the field, to reduce the number of turns at the headland. However, it may be better to sacrifice the long furrow for the advantage of having the

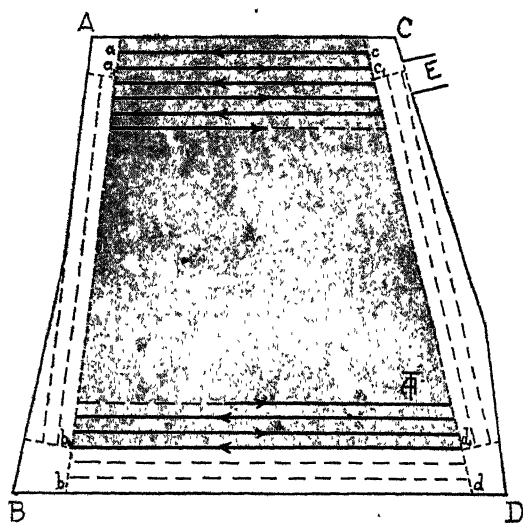


Fig. 1. — Furrows between two parallel sides of an irregular field.

furrows between two regular and parallel sides, as in Fig. I, so as not to leave wedge-shaped pieces that would have to be finished with a team or by hand.

b) In this case it is best not to carry the furrows up to the irregular lines  $AB-CD$  of the other ends of the field, but rather to stop them on the rectilinear line  $ab-cd$ , so that the work will be easier to finish, either with a team or with the machine itself.

c) The entrance into the field should never (as in any system of ploughing whatever) be forgotten, and the order of the work should be subordinated to it so that, when the work is finished, the machine does not need to pass over the ploughed ground. Thus in the case of Fig. I, where  $E$  is the entrance to the field, the ploughing will be commenced at  $ac$ ,  $a, c, \dots$  up to  $b, d$ , that is, at such a distance from  $BD$  as will allow the machine or the team to pass to finish the headland  $b, d, BD$ . Afterwards, the headland  $ab-AB$  is first ploughed, then the strip  $b, d, -bd$  and finally the headland  $cd-CD$ , the machine leaving the field at the entrance  $E$ .

By ploughing without ridges, the whole of the field can be ploughed, save the small areas at the ends of the headlands necessary for the machine to turn in, proportional to the width of the headlands (1) and which are worked by hand.

When balance ploughs are used the width of the headland is approximately equal to the distance between the two extreme, opposite ploughs. In the case of turnwrest ploughs and double-Brabants, it depends on the breadth of the always-necessary *double, or figure-of-8, turns* that the machine can take, providing that it is not a question of machines with a central gripping-drum, which, up to a certain point, can turn on themselves.

2) FELLEMBERG PLOUGHING. — As is well known, it is difficult to turn perfect furrows on a curve so that this system is not advisable in all our soils (in Italy) where the ploughing is usually heavy and deep, the earth being turned over as evenly as possible.

On the other hand this system is much used in America where the large regular spaces, the friable, light soils, and the shallow ploughing, give a certain liberty as regards beginning ploughing, and where rapid work together with the maximum yield from the machine are required rather than regular and perfect ploughing.

With this system the time lost in turning when not working is certainly at a minimum (theoretically it should be nil), as the fatigue caused by turning when working is also minimised, but, on the contrary, very large triangular plots (the size of which increases with the size of the field and the acuteness of the angle) are left in the corners of the field, thus necessitating their being worked with a team or by hand, or even, if so desired, with the machine, but with a great loss of time.

(1) The headlands are best not ploughed with cable-hauled machines, but rather with a team. But if this is required a free strip should be left along  $AC$ , so that the machine can leave the field with the anchors or anchor-wagon, etc.

In order that ploughing may proceed normally and uninterruptedly the field should first be carefully and visibly marked out (by poles, plaster, furrows, etc.) to show the points and geometrical lines symmetrical to the sides of the area and indicating any changes in direction of the furrows.

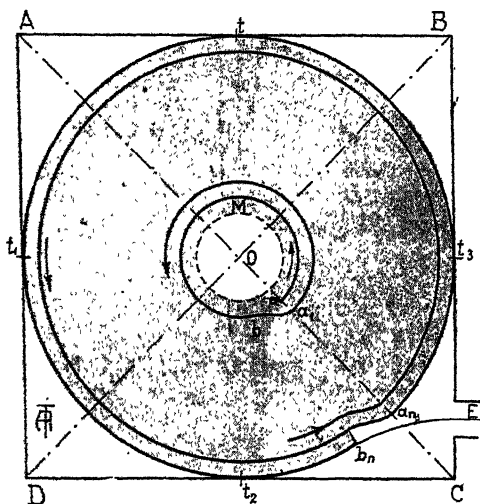


Fig. 2. — Felleberg method: application to a square field.

As an example of this procedure let us take a four-sided equilateral field (square or lozenge-shaped) as in Fig. 2. After finding the centre  $O$

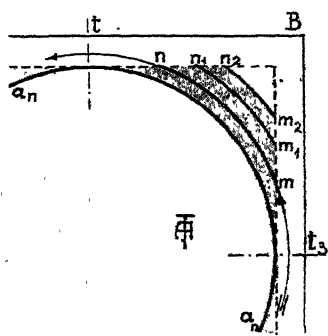


Fig. 3. — Felleberg method: finishing the corner of a square field in decreasing arcs.

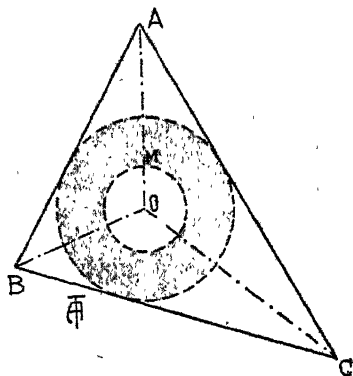


Fig. 4. — Felleberg method: application to a triangular field.

of the field (where the diagonals  $AC$ ,  $BD$  intersect) a circle  $OM$  is described equal to the maximum turn possible to the machine. Then, round this

circle ploughing is begun, at  $a$ , for example, in a circle concentric to  $O$ . When the machine has arrived at  $b$ , near the starting point  $a$ , it is turned outwards by a distance equal to the breadth of the gang, and the second circle concentric to  $O$  is started at  $a_1$ , and so on, up to the last circle,  $a_n$ , at a tangent to the edge of the field. The spaces in the circle  $OM$  and the triangles  $A, B, C, D$ , are then worked, either by hand, with a team or the machine itself according to their area. In the last two cases sufficient space should be left by the last circle  $a_n$  between the last furrow and the edge of the field to allow the machine, etc., to pass from one corner of the field to another in order to plough the decreasing areas  $mn, m_1 n_1, \dots$  (Fig. 3) at each angle (1).

The procedure is similar in the case when the field is triangular (Fig. 4); the centre  $O$  is at the point of intersection of the bisectors of the angles  $A, B, C$ , but the plots left unploughed are larger owing to the acuteness of at least 2 angles.

If the field is rectangular or rhomboidal (Fig. 5), the points where the bisectors of the angles  $A, B, C$ , intersect are at  $M, N$ . The line  $MN$  is the line of symmetry of the field, and should be visibly marked in a rectangle formed by the lines  $ab, cd$  perpendicular to the parallel sides of the field.

Then, with  $M$  and  $N$  as centres, the half-circles  $b_1 C_m a_1$  and  $c_1 C_n d_1$  (2) with the radii  $MC_m$  and  $NC_n$  respectively and the lines  $ad$  and  $bc$  are marked on the ground, and ploughing of the zone enclosed by these lines is begun as shown in Fig. 6. After opening the median furrow  $C_m C_n$  on the line of symmetry, with an ordinary double breasted plough, ploughing is begun, and furrow 1 is turned throwing the soil to the right. When the limit marked by the half-circle  $a_1 C_m b_1$  is reached the gang is lifted and a figure-of-8 turn made in the direction of the arrow, to open furrow 2 on the return, always throwing the soil to the right and so on, until the machine arrives at  $d_1$ , when the ploughing becomes continuous, turning around the part already ploughed (shaded area of Fig. 5) to complete the work.

Some authors (3) advise a procedure shown in Fig. 7: the first furrow is started at  $M$ , and, at  $N$ , the machine is turned to the right, ploughing a small curve  $Nn$ ; the ploughs are then lifted and a figure-of-8 turn made to return to  $n$ , when the machine ploughs along the line  $n N_1 M_1 m$ ; at  $m$

(1) This method recalls to mind the following very original one, known now for some years, but unsuitable for large areas:—a cable attached to the machine was rolled round a strong post planted firmly in the centre of the field; as the machine advanced, it tended to move in a straight line but, being held by the cable, it was obliged to turn round the post unrolling the cable, and ploughing in the fashion of an Archimedean spiral instead of concentric circles.

(2) To speak exactly, the machine, in describing the curves on starting from the straight line, describes spirals rather than circles.

(3) See "Farm Power", published by the INTERNATIONAL HARVESTER CO., of Chicago. — *Journal d'Agriculture pratique*, 1917, No. 6. — *Le Génie rural*, 1917, No. 66. — See also *R.*, 1917, No. 574.

the ploughs are again lifted, and another figure-of-8 turn made to return to  $n$ , and so on, until having reached the minimum turning radius of the machine at  $c_1$ , it ploughs round the plot already ploughed, as in Fig. 6, that is, it successively describes the half-circles concentric to  $M$

*Fellemberg method.*

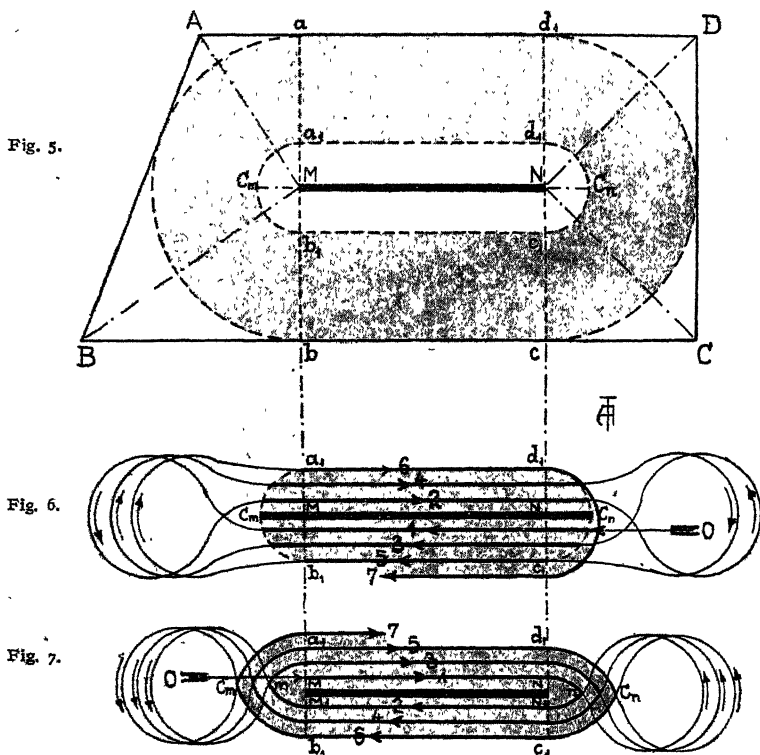


Fig. 5. — Application to a trapezoidal field.

Fig. 6. — Preparation of internal area without ploughing in curves.

Fig. 7. — Preparation of internal area by ploughing in curves.

and  $N$  (Fig. 5) and the straight furrows between  $ab$  and  $cd$ . In any case this procedure makes it very difficult to plough on the curved lines  $Nn$   $nN_1$   $M_1m$ . . . . . without considering the fatigue caused by the continual double turns at the end of the furrow (1).

(1) In cases such as Fig. 5, some authors, particularly BERTHAULT (cf. BARRAL and SAGNIER, *Dictionnaire d'Agriculture*, Vol. III, p. 412), have proposed the following method



As is shown in Fig. 5, and as would be expected, the *dead* angles, *i. e.*, these remaining to be ploughed, are all the narrower as the maximum radius of curvature *Ma* is smaller. It will, therefore, be seen that it is advisable to consider a field as composed of a num-

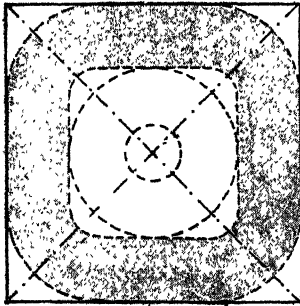


Fig. 8. — Ploughing the internal square by the method of fig. 2.

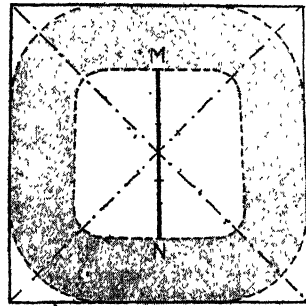


Fig. 9. — Ploughing the internal square by the method of fig. 5.

ber of rectangular or rhomboidal plots and to plough each of them successively. Thus, the square piece in Fig. 2 can be considered a made up of 2 rectangular plots *Att*, *D* and *tBCt*,, which should be ploughed separately according to the method described above. Again, the field may be considered to be divided into 2 squares, one inside the other, the internal square being ploughed first, either by the method shown in Fig. 2 (Fig. 8) or by that shown in Fig. 5 (Fig. 9), being continued by the Fellenberg method round the square.

Fig. 10 shows the case of an irregular 4-sided field. After finding the bisectors of the 4 angles and their points of intersection *M* and *N*, parallels to the sides *BC* and *AD* are drawn to meet the bisectors of the respective angles *C* and *D* in *c* and *d*, thus forming the triangle *Mcd*. From the apices of this triangle the lines *Ma*, *Mb*, *cc*, *dd*, *cc*, *dd*, *dd*, *dd*, are drawn perpendicular to the sides of the triangle, then, with *M*, *c*, and *d* as centres, arcs of a circle contained between these perpendicular are drawn, completing the triangle *OPQ*. For the interior of this triangle, with *N* as centre, the procedure is that of Fig. 4, then all outside the triangle up to the edge of the field is ploughed.

of ploughing, starting, from outside: — at 1 metre from the bisectors and the median line, parallel lines are drawn on each side enclosing headlands 2 metres wide. The first furrow is turned along the edge of the field and then the work gradually proceeds inwards in straight decreasing furrows, while the ploughs are lifted or earthed at each angle turn at the headlands, which are finally split again. This method, however, does not observe the principle of *continuous* labour proper to the Fellenberg system, and, moreover, it necessitates heavy work at the turns and it results in leaving triangular areas between the bisectors that have to be worked by hand.



## SECOND PART ABSTRACTS

### AGRICULTURAL INTELLIGENCE

#### GENERAL INFORMATION.

950 - **Facilities accorded to Official Agronomists for the Purchase of Automobiles, in Canada.** — SAVOIE, F. N. (Secretary, Ministry of Agriculture), in the *Journal of Agriculture* (Organ of the Minister of Agriculture for the Province of Quebec), Vol. XXI, p. 180, Quebec, June 15, 1916.

LEGISLATIVE  
AND  
ADMINISTRATIVE  
MEASURES

As farmers are asking more and more the aid and advice of the official agronomists, the Minister of Agriculture for the Province of Quebec has authorised all the agronomists to buy an automobile to facilitate their work. In order to encourage the agronomist to take care of the machine he has the choice between 2 systems of purchase : — 1) annual repayments of 20 % + 6 % interest on the cost price ; 2) immediate repayment of  $\frac{2}{3}$  the cost price.

In both cases the automobile remains the property of the agronomist ; the annual licence, fire insurance, running costs (petrol, oil, repairs), are paid for by the Ministry. The systems are based on a buying price of \$ 1 200.

The agronomist has to keep an account of his expenses and the monthly mileage covered on official work.

Both systems were tried in 1917, with satisfactory results.

Some agronomists have travelled more than 10 000 miles. Four chose the repayment by annual amounts, the rest preferring that by  $\frac{2}{3}$ .

951 - **On the Possibility that Man can Live on a Diet Containing No Fat; Researches in Denmark.** — *Ugeskrift for Lægevidenskaben*, Year 63, No. 22, pp. 296-298. Copenhagen, May, 1918.

RURAL  
HYGIENE

Previous researches aiming at ascertaining if there is a minimum of fat required in the human diet have lead to the general conclusion that man cannot live without a certain quantity in his diet, otherwise he will become unhealthy and may even endanger his life. Physiologists are not agreed as to the exact daily minimum of fat required by the human being for continued well-being. VOIT fixed the amount at 56 gm., TIGERSTEDT at 80 or 100 gm., while SOFUS TORUP also indicates the latter figures and says that, during the present war, a characteristic unhealthy state has

appeared which he calls "fedthunger" (fat hunger) and which has appeared in those countries where there is a shortage of fats, a state resembling that of Nansen's companions in the Greenland expedition. Numerous researches, using rats, have been made in the United States on this subject; when the rats received a diet absolutely free from fats, they became diseased, recovery being obtained on giving them the substances that were lacking. But the substances under question acted specifically in this case, some having a positive action, *i. e.*, producing recovery (fat from butter, egg yellow, liver oil, etc.), while others (fat from pig, olive oil, almond oil, etc.) did not bring about recovery or the return of the animals to the normal state. It was concluded that the effect was not due to the fats themselves, and that it was once more a question of "vitamines" (1).

In order to obtain more definite information on the subject, Dr. HINDHEDE made some observations on two strong, healthy persons, one a gardener, aged 31 years, and the other a student, aged 24 years. The subjects received, for more than a year, a diet "practically" free from fats, consisting of bread, potatoes and vegetables, variation being obtained by introducing, at stated periods, sweetened gruel. The two subjects were kept in very good condition while they were fed on bread, potatoes and vegetables; on the contrary, however, they lost flesh when the vegetables were replaced by the sweetened gruel. HINDHEDE admits that young, robust persons can live in perfect health for 16 months (and more, as the experiment is still in progress) on a diet of bread, potatoes, cabbages, rhubarb and apples, while a diet composed exclusively of sweetened gruel could apparently not be tolerated for more than a month. He therefore concludes that the different vegetables contain vitamins similar to those found in fats, and that the latter can be very well dispensed with provided they are replaced by vegetables. This also explains the insufficiency of the sweetened gruel. Owing to present circumstances the diet in Germany is characterised by penury of fats; although, generally speaking, the effects of such a state of affairs have not been so serious as might have been supposed, certain unhealthy conditions have appeared, contrary to the observations of HINDHEDE, amongst which is that called "Kartoffelkrankheit" (potato disease) by DÖLLNER; but it appears that this disease was cured by adding vegetables to the potatoes. Similarly, HINDHEDE attributes all the unhealthy conditions produced in Germany by the lack of fats to the lack of vitamins in the food. He thinks that there is no great need of alarm at the prospect of an eventual total lack of meat and fat, provided that care is taken to supply sufficient seeds, potatoes and vegetables.

In conclusion, HINDHEDE deduces some observations of practical value from his thesis. Those who have little land should devote as much as possible of it to market-gardening. In this way it has been calculated that Denmark could maintain 20 million individuals, if the live stock industry were suppressed. Although the exclusive growth of plants

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(1) See *R.*, July, 1918, No. 719. (*Ed.*)

is not desirable and as these deductions are obviously as yet insufficiently sure to allow of their practical use, they are of great interest from the physiological point of view in that they apparently show that the human being can, without much risk, do without fats during a certain period.

952 — **The Feeding of Cattle and "Barlow's Disease" in Children Caused by Milk.** — *Nordisk Mejeri-Tidning*, Year XXXIII, No. 24, p. 284. Stockholm, June, 1918.

"Barlow's disease" so resembles scurvy that it is often called infantile scurvy. It appears in children fed exclusively on sterilised and boiled milk. It is obvious that the time required in heating milk has an influence on its vitamine content. Moreover, it is generally believed that milk is richer in vitamins during the summer when the fodder given to the cattle is fresher, than in winter when they chiefly feed on dry fodder. On the other hand, if roots are fed heavily in winter, milk might be produced that is richer in vitamins than the milk usually produced during that season, and thus have the effect of rendering the appearance of Barlow's disease more rare.

In any case, it is safest to pasteurise milk for children at a low temperature, the best method being to heat the milk for 30 minutes at 63° C.

953 — **Bacterial Precipitins and the Detection of *Bact. botulinus* in Preserved Foods by the Thermo-Precipitation Method.** — See No. 1047 of this Review.

954 — **Investigations into the Possibility of Calculating the Experimental Error in Field Experiments.** — GORSKI, M. and STEFANIOF, M. (Landwirtschaftliche Hochschule Dublany bei Lemberg), in *Die landwirtschaftlichen Versuchs-Stationen*, Vol. XC, Pt. 3 and 4, pp. 225-240. Berlin, 1917.

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

Recently the experimental error has been calculated in field experiments in many different places, but without much attention being paid to the possibility of its practical application.

Practically the only important works on this subject are: — 1) that of TH. PREIFFER and E. BLANCK (*Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXIII, p. 331, 1914) in which, according to the authors, too few experimental plots were used; 2) the investigations of TH. REMY (*Landwirtschaftliche Jahrbücher*, Vol. XLIII, p. 453, 1912), which are not very conclusive because not carried out under consistent conditions; 3) the important, but little known work of E. ZALESKI (Anleitung zur Ausführung vergl. Versuche mit verschiedenen Zuckerrübensorten, aus dem Polnischen vom Verfasser übersetzt, 2. Ausgabe, Krakau, 1912), which, unfortunately has not been completely published; 4) the very exact investigations of TULAIKOV (*Journal Opitnoi Agronomii*, 1913); 5) P. EHRENBURG's study (*Die landwirtschaftlichen Versuchs-Stationen*, Vol. LXXXVII, p. 29, 1915), in which the author, basing his own experiments on those of W. B. MERCER and A. D. HALL (*Journal of Agricultural Science*, Vol. IV, p. 107, 1911) (1) shows clearly the agreement of the results obtained with the theory of the least squares: however, in spite of the abundant data EHRENBURG considers his work to be

(1) See R., January, 1912, No. 29. (Ed.)

only an attempt to prove that the experimental error may be calculated in field experiments; he believes the results obtained in the field to follow in general GAUSS' law, so that the calculation of the experimental error may be applied to them. Nevertheless, he considers it necessary to collect more abundant data before the possibility of applying such a calculation to field experiments can be scientifically assured.

In order to supply further control data the authors carried out new investigations and experiments in the grounds of the "Landwirtschaftliche Hochschule" (Agricultural College) of Dublany, near Lemberg, Galicia, in a series of 200 plots of sandy loam soil and 300 plots of loess soil. The plants used were oats.

The arithmetical mean of the crops obtained from each plot, 10.76 square yards in size, was first taken, and the deviation from this average determined for each plot. The experimental error was then calculated

by the formula  $r = 0.674 \sqrt{\frac{\sum v^2}{n-1}}$ , where  $r$  represents the probable error,  $\sum v^2$  the total of the squares of all the deviations without considering their sign, and  $n$  the number of observations.

RESULTS. — Those of the first set of experiments, in sandy loam, agree very well with GAUSS' law of errors. The number of positive and that of negative deviations are practically equal, and the extent of the deviation agrees well with the values calculated. If the extent and the sign of the deviation are considered together, a satisfactory agreement with GAUSS' law is also found.

In the second set of experiments, in loess, there is a yet better agreement between the deviation found and that calculated. On the other hand there is a certain disagreement between the deviation sign; instead of 150 positive and 150 negative deviations, there are 139 of the first and 161 of the second. The difference is, however, not sufficiently large for it to be said that the deviations do not follow GAUSS' law, as this can only be fully applied to an infinite set of observations.

The experimental errors (deviations from the average) in the two sets are accidental errors, to which the theory of the experimental error may well be applied. This does not, however, hold good for all field experiments, but it may be admitted that, in experiments carefully carried out in homogeneous soil, the errors which occur are only accidental.

955 — **Agricultural Experiment Stations of Canada.** — I. *The Canada Year Book* 1916-17, pp. 236-249. Ottawa, 1917. — II. *Dominion Experimental Farms; A Guide to the Experimental Farms and Stations.* Ottawa, 1912. — III. *Annual Reports of the Experimental Farms and Stations.* Ottawa. — IV. *The Agricultural Gazette of Canada.* Ottawa. — V. *Bulletins, pamphlets, circulars of the Dominion Experimental Farms Branch.* Ottawa.

In Canada there are the Dominion Experimental Farms and Stations administered by the Experimental Farms Branch of the central Department of Agriculture of the Government of the Dominion and the Provincial Colleges, Schools and Departments of Agriculture which also conduct agricultural experiments.

DOMINION EXPERIMENTAL FARMS AND STATIONS. — Under the Experimental Farm Stations Act, 1886, were established a Central Experimental Farm at Ottawa for Ontario and Quebec, and four branch Farms:— 1) for the Maritime Provinces at Nappan, Nova Scotia; 2) for Manitoba at Brandon; 3) for the North-west Territories at Indian Head, Saskatchewan; and 4) for British Columbia at Agassiz. After these five Farms had continued in operation for 20 years, the first steps were taken towards their extension in number by the establishment of new Experimental Stations for Alberta, viz., one at Lethbridge in 1906 and the other at Lacombe in 1907. Since this date development in the number of the Farms and Stations, and in the work carried on by them, has been rapid and continuous; and every province has now one or more Farms or Stations. The five original farms established in 1886 are known as "Experimental Farms", those added since are styled "Experimental Stations"; no distinction in the work is expressed by these titles.

*Dominion Experimental Farms and Stations, 1916.*

Farms or Stations	Province	Acreage	Date established
Central Farm, Ottawa . . . . .	Ontario	467	1886
Kapuskasing Station . . . . .	"	1 000	1916
Charlottetown Station . . . . .	Prince Edward Island	100	1909
Nappan Farm . . . . .	Nova Scotia	300	1886
Kentville Station . . . . .	"	294	1912
Fredericton Station . . . . .	New Brunswick	520	1912
Ste. Anne de la Pocatière Station . .	Quebec	340	1911
Cap Rouge Station . . . . .	"	339	1911
Lennoxville Station . . . . .	"	455	1914
Spirit Lake station . . . . .	"	1 200	1916
Brandon Farm . . . . .	Manitoba	625	1886
Morden Station . . . . .	"	280	1915
Indian Head Farm . . . . .	Saskatchewan	680	1886
Rosthern Station . . . . .	"	650	1908
Scott Station . . . . .	"	520	1910
Lacombe Station . . . . .	Alberta	850	1907
Lethbridge Station . . . . .	"	400	1906
Invermere Station . . . . .	British Columbia	53	1912
Summerland Station . . . . .	"	550	1914
Agassiz Farm . . . . .	"	1 400	1886
Sydney Station, Vancouver Island . .	"	125	1912

Summing up, in 1916 there were altogether 21 Farms and Stations with an increased acreage over 1915 of 2 213, or a total average of 11 148, as compared with the original five Farms, having a total area of 3 472 acres.

Ranging over the whole of the wide fields of agriculture, arboriculture and horticulture, the work of the Farms has included experiments and studies relating to the breeding and feeding of farm live stock, the production of butter and cheese, field crops, natural and artificial fertilisers,

cereals, grasses and other forage plants, fruits, vegetables, plants, trees, plant diseases and injurious insects. The Farms are also bureaux of information to which agriculturists resort for practical advice. In addition to the farms and stations included in the foregoing table there are 7 small substations at Salmon Arm, British Columbia, at Fort Vermilion, Grouard and Beaver Lodge in Alberta, and at Forts Smith, Resolution and Providence, in the Northwest Territories.

The more strictly scientific side of the work is carried on at the Central Experimental Farm at Ottawa, and is organised in thirteen divisions as follows : — 1) Field Husbandry ; 2) Animal Husbandry ; 3) Horticulture ; 4) Cereals ; 5) Chemistry ; 6) Forage Plants ; 7) Botany ; 8) Poultry ; 9) Tobacco ; 10) Economic Fibre ; 11) Illustration Stations ; 12) Apiculture ; 13) Extension and Publicity. What was formerly the Entomological Division became in 1914 the separate Entomological Branch of the Department of Agriculture.

Only brief mention is possible of the more striking results already achieved, with some indication of the work now being carried on. In the field of *General Agriculture*, the importance of early sowing was demonstrated by a series of experiments which lasted from 1890 to 1899. As the result of experiments on the branch Farms in the West, the practice of summer fallowing for the conservation of moisture and the destruction of weeds is widely followed in the Prairie Provinces. Experiments continued from 1893 to 1910, have shown over large areas in Canada the economic advantage of applying fresh as compared with rotted farmyard manure. In the *Cereal Division*, notable work has been done in the production of new varieties of grain, especially wheat possessing the qualities of productiveness, an early ripening habit and good baking strength. Varieties of wheat known as Preston, Stanley and Huron are all vigorous and productive, and ripen early ; but the variety that has achieved the greatest success is the Marquis, which is equal to Red Fife in baking qualities, ripens from 5 to 10 days earlier and is superior in productiveness. It is now rapidly superseding Red Fife throughout the Northwest.

Experiments carried on over a series of years by the *Field Husbandry Division*, show the advisability of a rotation which includes a cereal crop, a hay crop (including clover) and a root crop. In the *Division of Animal Husbandry*, extensive breeding experiments are in progress. Important work has been done in the demonstration of effectively ventilated stables and cow barns. The *Division of Horticulture* carries out numerous experiments with apples, plums, cherries, grapes, small fruits and vegetables. Many varieties have in past years been tested, and promising seedlings for different latitudes have been recommended to growers. The object of the experiments with apples has been to obtain, by cross fertilisation and selection, new varieties that will stand the severe winters, also varieties of better keeping qualities. Experiments were begun in 1915 to test the possibility of growing root and vegetable seeds in Canada instead of importing them from abroad. So far as they have gone, the experiments have proved successful and are being continued. In the *Division of Botany*,



investigations of the diseases of cultivated plants are carried on, and advice is given as to remedial measures wherever possible. Weeds are identified and methods of eradication recommended. Wild plants from all parts of Canada are received for identification, and information is furnished as to whether they are edible, medicinal or poisonous. Tests are also made as to the suitability of the climate of Canada for the growth of various plants of economic importance, such as fibre plants (flax, hemp), medicinal plants (opium-poppy, anise, etc.), oil-yielding plants (castor oil, soy bean), and miscellaneous plants (mustard, chicory, etc.). Much has been accomplished in *Arboriculture* not only by setting apart 65 acres at the Central Experimental Farm for the testing of trees and shrubs from all parts of the world, but also by the encouragement given to tree-planting in the western provinces.

The *Division of Chemistry* covers a large field, and the Dominion Chemist, who is also Assistant Director of the Farms, controls a staff of nine fully qualified chemists. Investigations have been conducted to determine the nutritive value of fodder plants by analyses at different stages of their growth. Canadian grown cereals have been analysed to ascertain their quality and nutritive value, and the straw has also been examined to determine its value as fodder. Analyses have been made of soils from different parts of the Dominion. Investigations have been made into farmyard manures. Many experiments have been conducted to throw light on the factors affecting soil moisture, and means have been suggested whereby the desired conditions of moisture may, to a great extent, be obtained and controlled by cultural operations. The influence of environment on the composition of wheat has been studied since 1905, and the work has now been enlarged, through co-operation with the Dominion Meteorological Service at Toronto, to secure a more comprehensive and detailed study of the relationship between weather conditions and crop growth. Analyses of sugar beets have been useful in demonstrating the suitability of soil and climate at widely different points of the Dominion for the growth of roots of high sugar content and purity. Well waters from farm homesteads have been the subject of special study. Numerous analyses are made in conjunction with problems relating to the land, the crop and the animal which from time to time are submitted by farmers for solution. Analyses are also made of dye stuffs, preservatives, pickling solutions, etc., and systematic investigational work with commercial fertilizers is now being carried on. Owing to the scarcity of potash caused by the European war, the preparation of a nitro-potassic fertiliser by the drying and grinding of seaweed was undertaken at a point on the coast of Nova Scotia. The fertilising value of the material so prepared is being tested in the field.

The *Poultry Division* undertakes experiments in the breeding, etc., of farm poultry. Demonstrations in poultry keeping are made, chiefly for the purpose of proving locally that farm poultry rather than the poultry farm is profitable.

Experiments in the growth of *tobacco* are carried on by an expert

from France at Ottawa, assisted by local superintendents at the tobacco stations of St. Jacques l'Achigan, and Farnham, Quebec and Harrow, Ontario. In 1912 a *Division of Forage Plants* was established under the direction of a scientific officer from the Plant Breeding Station at Svalöf in Sweden. The Division has for its object improvement in the quality and yield of grasses, clovers, alfalfas and other forage crops grown in Canada. An Economic Fibre Division was established at Ottawa early in 1916 to investigate the possibilities of the flax fibre industry in Canada. Hemp growing is also being tried.

*Illustration Stations* were started in 1914 by the selection of small areas at different points in Saskatchewan and Alberta, the object being to show to farmers in the district selected the best cultural and crop methods. Early in 1915 the Illustration Station work inaugurated by the Commission of Conservation was taken over by the Experimental Farm Branch. In 1915 a *Division of Extension and Publicity* of the same Branch was formed for the purpose of making the work of the Experimental Farms more widely known amongst the farmers of Canada. The Division issues every four months a publication entitled "Seasonable Hints", which gives timely notes and advice to help the farmer in his current work.

PROVINCIAL AGRICULTURAL EXPERIMENTS. — In *Nova Scotia* at the College of Agriculture, Truro, about 400 acres are devoted to general farming and gardening and to investigations (application of ground limestone; fertiliser experiments; experiments with varieties of oats, wheat, barley, etc.; feeding experiments; influence of various stocks of the apple on the scion; collection of cherries and plums; variety tests of strawberries; hill selection of potatoes; etc.); experiments are also conducted in the chemical, entomological and botanical laboratories.

In *Quebec* the Macdonald College, Ste. Anne de Bellevue, comprises 786 acres divided as follows: — main farm, 584 acres; cereal husbandry plots, 75 acres; poultry department, 17 acres; orchards, 35 acres; vegetable gardens, 25 acres; recreation fields, 50 acres. Experiments are carried on in animal husbandry, cereal husbandry, poultry, chemistry, bacteriology, horticulture, biology and physics. The Oka Agricultural Institute is one of the oldest experimental farms in Canada; a large number of dairy cattle are kept and experimental work is carried on with these and with swine, poultry and bees; horticulture is practised largely; the growth of small fruits is a speciality and the vineyards are celebrated. The School of Agriculture, Ste. Anne de la Pocatière, owns more than 500 acres of land, where besides general cultivation a number of experiments are also carried on.

The *Ontario* Agricultural College and Experimental Farm, Guelph, were established in 1874 to train young farmers in the science and practice of agriculture and to conduct agricultural experiments for the benefit of the province. Research and experimental work is conducted in the departments of field husbandry, animal husbandry, horticulture, chemistry, dairy, poultry, physics, bacteriology, entomology, botany and apiculture.

In *Manitoba*, at the College of Agriculture, Winnipeg, field husbandry

experimental work was inaugurated in the spring of 1915 and was divided into 3 divisions:— cereal crops; forage crops; soil and crop management.

The College of Agriculture, Saskatoon, *Saskatchewan*, has a farm of 880 acres which is devoted to diversified agriculture; investigations are being made to ascertain the carrying power of prairie lands under different crops for the production of meat and milk; in grading up farm flocks from the common range ewes; cheap housing for sheep, swine and poultry; in silage production from crops other than maize, such as oats and peas, sweet clover, alfalfa; another section has been set aside for investigations in tillage, crop production, crop improvements, variety tests and rotations; the effects of different artificial fertilisers with farmyard manure are being tried; garden and fruit crops, trees, shrubs and flowers are being introduced for the purpose of testing varieties and methods of management, under prairie conditions.

A College of Agriculture has been established at the new University of *Alberta*, Edmonton South, where at present over 100 acres of land are available for experimental work in cereals, grasses, clovers, hoed crops, small fruits, vegetables and flowers; work is being started with soils and excellent foundation stock has been secured in pure-bred cattle, sheep and hogs. Experimental work at each of the three provincial Schools of Agriculture at Paretholm, Olds and Vermilion has been carried out by the Alberta Department of Agriculture since October, 1914.

Finally experiments are being carried out by the Live stock and Horticulture branches of the *British Columbia* Department of Agriculture; the Live Stock branch is conducting one experimental plot of 13 acres, another of 10 acres, 11 plots from 4 to 5 acres and 6 one-acre alfalfa plots; work in drainage and the correcting of soil acidity is being carried out in one plot; where plots are located in newly-settled districts, the work partakes largely of tests to determine the best crops and varieties for local conditions; on other plots a rotation system suitable for the district represented is being established, and as far as possible the work is carried on in co-operation with the local Farmers' Institutes, and where practicable the plots are used as a centre of good seed production; the horticultural branch too is operating vine demonstration and experimental orchards of five acres each, which are planted and cared for under a co-operative arrangement by which the owner of the land and the Department share the expense, the agreement covering a five-year period, but in some cases further agreements are being made.

At the University of British Columbia the experimental results obtained by the Department of Agronomy during 1915-16 with all classes of field crops have proved of great value in determining the best methods of bringing heavily timbered uplands under cultivation; the allotments of land made to the Departments of Agronomy and Horticulture are being specially prepared for investigational work, and in Animal Husbandry special attention will be given to feed problems in connection with cattle, swine, sheep and poultry; over 25 000 specimens of the native flora of the province, representing nearly 800 species, have been transferred to the

Botanical garden and constitute the most representative botanical collection of British Columbia.

## CROPS AND CULTIVATION.

AGRICULTURAL  
METEOROLOGY

956 - Chemical Composition, from an Agricultural Point of View, of Rainwater Collected at Montevideo, Uruguay, from 1909 to 1912—SCHROEDER, J., in the *Revista del Instituto Nacional de Agronomía de Montevideo*, Ser. II, No. 1, pp. 29-48. Montevideo, January, 1918.

In a previous report (*Revista del Instituto N. de Agronomía*, Montevideo, 1910, No. 7, p. 123) the author published the results of his observations on the carbonic acid content of the air at Montevideo. These results showed that the amount of the gas present varies greatly with the season and the direction of the wind. The average content is 2.98 volumes per 10 000 volumes of air under normal conditions, at 0°C and 760 mm.

The report under review gives a series of data relating to the amount of nitrogenous compounds, chlorides (expressed as sodium chloride) and organic matter carried to the soil by rainwater during the period 1909-1912. The work done on the chemical composition of rainwater in all parts of the world is first reviewed rapidly, and the author then gives the results of his own observations, which are summarised in tables. These observations, made at the Sayago experiment field at the Agricultural Institute of Montevideo, lead to the following conclusions:—

With a total precipitation of 1504 mm. per annum (in 1912), 1 acre of the Sayago experiment field received 6.88 lb. of combined nitrogen, of which 3.28 lb. was ammoniacal and 3.60 lb. nitrous and nitric. At the end of 24 months of observation (May to September, 1908; October, 1911 to February, 1913) the same area received 7.03 lb. of ammoniacal nitrogen and 6.09 lb. of nitric nitrogen, *i. e.*, 12.23 lb. of nitrous and nitric nitrogen, or 6.10 lb. per acre annually. The nitrogen content of rainwater of 18 tropical countries and of 96 temperate countries (50 observations) is given. A comparative examination shows that the figures obtained at Sayago are slightly higher than those for the tropical and temperate countries.

The author was unable to prove that the seasons had any influence on the amount of nitrogen, which, moreover, he thinks only worth considering as a source of nitrogen for agriculture. The quantity of chlorides (expressed as sodium chloride) carried to the soil by rainwater is 73.60 lb. per acre. The chloride content of the rainwater seems to depend on the direction of the wind while the rain is falling.

The amount of organic matter (calculated in milligrams of oxygen required to burn it) was on an average 750 mgm. of oxygen per 1 000 litres of rainwater. The evaporation residue of rain is, on an average 303 lb. per acre annually, of which 108 lb. disappear on burning and 195 lb. form a non-volatile residue.

In conclusion the author points out that these figures refer to the Montevideo district and not the interior of the country.

957 - Some Notes on the Direct Determination of the Hygroscopic Coefficient. — ALWAY, F. J., KLINE, M. A. and McDOLB, G. R., in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 147-166 + Bibliography of 27 Publications. Washington, D. C., October 22, 1917.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

The hygroscopic coefficient expresses the percentage of moisture contained in a soil which, in a dry condition, has been brought into a saturated atmosphere, kept at a constant temperature, and allowed to remain until approximate equilibrium with this atmosphere has been attained. It has a twofold significance, both serving as single-valued expression of the relative fineness of texture, and, in soil-moisture studies, permitting the approximate estimation of the maximum amount of water available for growth and for the maintenance of plant life — the difference between the total amount of water and the hygroscopic coefficient.

The error is sometimes made of confusing MITSCHERLICH's "Hygroskopizität" with the hygroscopic coefficient as above defined. The former is determined by allowing the exposed soils to come into equilibrium with an atmosphere in contact with a 10 per cent sulphuric acid solution instead of with water, MITSCHERLICH holding that the determination by HILGARD's method gives results much too high on account of the condensation of moisture on the exposed samples.

HILGARD's method was described by him (Report on the Methods of Physical and Chemical Soil Analysis, *U. S. Dept. of Agr., Division of Chemistry, Bulletin* 38, 1893, pp. 60-82) as follows: —

The fine earth is exposed to an atmosphere saturated with moisture for about twelve hours at the ordinary temperature (60° F.) of the cellar in which the box should be kept. For this it is sifted in a layer of about 1 mm. thickness upon glazed paper, on a wooden table in a small water-tight covered box (12 by 9 by 8 inches) in which there is about an inch of water; the interior sides and cover of the box should be lined with blotting paper, kept saturated with water, to insure the saturation of the air.

After eight to twelve hours the earth is transferred as quickly as possible, in the cellar, to a weighed drying-tube and weighed. The tube is then placed in a paraffin bath, the temperature gradually raised to 200° C. and kept there 20 to 30 minutes (rapidity of raising temperature depending upon the amount of moisture in the soil), a current of dry air passing continually through the tube. It is then weighed again, and the loss in weight gives the hygroscopic moisture in saturated air.

Some time later, to avoid the decomposition of the organic matter of surface soils, HILGARD modified the method to the extent of using an air bath, raising the temperature to only 110° C, keeping the sample in for an hour, weighing, drying again, and continuing the process until a practically constant weight was obtained.

The authors have tested this method by studying the following points: — rapid loss of hygroscopic moisture; suitability of trays of various materials; influence of time of exposure; effect of great fluctuations in the temperature of the room; effect of grinding; influence of size of absorption boxes and the number of tables; concordance of determinations:

in practice ; reliability of the method described by HILGARD ; modification of method when sample contains gravel or pebbles ; they arrive at the following conclusions : —

The amount of hygroscopic moisture absorbed increases with the rise of temperature. Drying of mineral soils at temperature of  $100^{\circ}$  to  $110^{\circ}$  C. does not appreciably decrease their hygroscopicity. Intractable samples may be reduced in a steel mortar to pass a 1 mm. sieve without appreciably affecting their hygroscopicity.

Twelve hour's exposure in the absorption boxes is sufficient only when the soil layer is very shallow. In practice a longer interval is found more convenient, 20 to 24 hours proving very satisfactory. An exposure of more than 24 hours gives higher values only in the case of very fine textured soils.

A soil containing the amount of moisture corresponding to its hygroscopic coefficient loses water very rapidly when exposed to an ordinarily dry atmosphere, but in determining the hygroscopic coefficient the time necessary to transfer the soils from the absorption boxes to weighing bottles is so brief that the loss during the transfer is too small to appreciably affect the accuracy of the results.

HILGARD'S method for the determination of the hygroscopic coefficient carried out exactly as he describes it, gives reliable results. However, the loose sheets of glazed paper used are very inconvenient when many determinations are to be made and may be advantageously replaced by shallow trays, either of aluminium or of copper. Trays of glass, graniteware, and vulcanized rubber give satisfactory results, but are less convenient, while those of tin plate or zinc, although satisfactory at first, soon corrode. Pasteboard trays lined with glazed paper give results much too low, unless the period of exposure be greatly prolonged, and even those of paraffined pasteboard lined with glazed paper give somewhat low results. Any considerable increase in the size of the absorption boxes over that recommended by HILGARD or the use of a larger number of exposed samples within the boxes of the same size cause too low results, unless the time of exposure be greatly increased.

958 — **The Relationship Between Absorption and Coagulation With Respect to the Mineral Colloids of the Soil.** — DOMINICIS, A. DE, in collaboration with CHIARERI, P. (Laboratorio di Chimica agraria della R. Scuola Superiore di Agricoltura di Portici), in *Le Stazioni Agrarie sperimentali italiane*, Vol. 4, Pt. 9-10, pp. 451-479. Modena, 1917.

In two earlier papers (*Rendiconti della Società Chimica italiana*, Vol. V, p. 285, 1913 ; *Le Stazioni sperimentali agrarie italiane*, Vol. XLVIII, p. 525, 1915 ; *Annali di Chimica applicata*, Vol. IV, p. 284, 1915) the author gave the results of a series of investigations into the relationship (resulting from an objective examination of facts) between absorption and coagulation. The general plan of the investigation was to determine the relationship between that which is absorbed and that which is coagulated, considering that each time a saline solution acts on a colloidal solution the resulting coagulation always determines a lowering of the concentration of one of the electrolytic constituents of the dissolved salt. The constituent thus acted on is that which, by reason of its charge, acts on the coagulation in

such a way that, when it is not a question of colloids easily subject to reciprocal replacement (as certain zeolites and soil in general), the saline solution may become acid or alkaline, according to the circumstances. In his previous papers the author showed this relationship to exist. The present paper gives a further experimental contribution which aims at making more clear the principles derived from the interpretation of the results. The method adopted in the new investigations did not differ from that of the preceding ones and consisted of verifying whether the ratio between the monovalent alkaline metals (ammonium, potassium and sodium) also exists for the bivalent alkaline-earth metals (calcium, barium, strontium and magnesium):— 1) by a study of the relationship with regard to the concentration of the active electrolyte; 2) with regard to the duration of the action of this electrolyte; 3) with regard to the absorbing power of the different metals; 4) with regard to the valency of these metals. The results, which agree with those of the previous investigations, confirm the following general principles:—

1) There is a real and constant relation between absorption and coagulation.

2) The action of the electrolytes determines a single process in the unstable hydrosols consisting of coagulation by absorption. When atoms and ions of opposite sign come into contact they attract each other reciprocally, causing the neutralisation of their respective charges and the formation of insoluble absorption combinations. This causes a lowering of the concentration either in the colloidal solution or in the electrolyte solution.

3) Considered separately, the two processes proceed in parallel, as the function of identical factors and in function one of the other, that is, they advance as the opposed signs of charge between the atoms and ions drop, and are seen to be connected by the relation of cause and effect.

4) The existence of this relation is of great importance as regards the physical-chemical properties of the soil, which are always influenced by it in a manner advantageous to fertility.

959 - **Influence of Nitrates on Nitrogen-Assimilating Bacteria.**—HILLS, T. L. (Research Bacteriologist, Idaho Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XII, No. 4, pp. 183-230 + 31 Tables + Bibliography of 49 Publications. Washington, D. C., January 28, 1918.

By far the greatest amount of work on the relation of nitrates to plant growth has been done in the realm of the higher plants. Very little attention has been given to the effect of nitrates on the lower plants, especially bacteria. Because of the relation that exists between higher plants and bacteria the author considered it advisable to study the effect of nitrates on certain groups of soil bacteria, including not only their reproduction but also some of their physiological properties. The soil bacteria studied were especially those forms concerned with the fixation of atmospheric nitrogen. The work followed two lines of investigation: First, the influence of nitrates on *Azotobacter* was determined. Here studies were made on the effect of nitrates on the growth of the organism in soil and also the effect

of these salts on the nitrogen-fixing property of these bacteria. The action of *Azotobacter* on nitrates in solution, the relation of nitrates to pigment production and to the formation of volutin bodies (1) were studied. Second, the influence of nitrates on the growth of *Bacillus radiculicola* in soil was studied. The action of *B. radiculicola* on nitrates in solution and the possible nitrogen-assimilating properties of the legume in the presence of nitrates were investigated. Also the influence of nitrates on gum production was determined. The latter part of the investigations included a study of the relation of nitrates to nodule formation on alfalfa.

The results are summarised as follows:—

1) Small quantities of potassium (10 to 100 mgm. in 100 gm. of dry soil), sodium, and calcium (10 to 150 mgm. in 100 gm. of dry soil) nitrates caused a great increase in the number of *Azotobacter* in sterilised soil. Ammonium nitrate in the same quantities caused a less marked increase. Higher concentrations were not so favourable to the growth of the organisms.

2) Potassium and sodium nitrates in the concentrations studied (as much as 150 mgm. of  $\text{NO}_3$  in 100 cc. of medium) caused an increase in the amount of nitrogen assimilated by *Azotobacter* on agar films. Calcium nitrate in the same amounts brought about a decrease in the amount of nitrogen fixed to a point even below that representing the amount assimilated in the absence of nitrates. In soil cultures nitrates of sodium and calcium caused an increase in total nitrogen, which was more marked in the unsterilised cultures than in those cultures sterilised and inoculated with a pure culture of *Azotobacter*. However, the increase in total nitrogen is not commensurate with the increase in the number of *Azotobacter* noted under the same conditions.

3) Under aerobic conditions *Azotobacter* in liquid cultures reduced nitrate to nitrite, but not to ammonia. More atmospheric nitrogen was assimilated in the presence of nitrate than in the absence of this salt.

4) Pigmentation occurred when potassium and sodium nitrates, and especially calcium nitrate, were used with *Azotobacter*, the colouration increasing with the concentration of the salt. This effect was more marked in *Azotobacter* strains which produce little or no pigment in the absence of nitrates.

5) All three nitrates studied caused an increase in the number and size of volutin bodies in *Azotobacter* cells. From all appearances these salts also tended to hasten the development of these bodies.

6) The number of *Bacillus radiculicola* in sterilised soil was increased by the addition of small quantities (as much as 50 mgm. nitrate in 100 gm.

(1) The presence of volutin bodies, or metachromatic granules in *Azotobacter* has been shown by BONAZZI. These substances, according to MEYER, are reserve food materials other than fat droplets, glycogen, and similar substances reacting with iodine stain which occur in the cytoplasm of the cells of various bacteria. With Millon's reagent they give no reaction. He believes that these bodies are composed of nucleic-acid compounds but are not nuclear proteins. (Author).



of dry soil) of potassium, sodium, ammonium, and calcium nitrates. This increase was not so marked as in the *Azotobacter* cultures. *B. radiculicola* appeared to be much more resistant to higher concentrations of nitrates than *Azotobacter*.

7) *B. radiculicola* under aerobic conditions did not reduce nitrates in solution to nitrite, ammonia, or elemental nitrogen. The presence of nitrates did not materially influence the small amount of atmospheric nitrogen fixed under these conditions.

8) When grown on agar films, *B. radiculicola* fixed a small amount of nitrogen, varying from 0.15 to 0.43 mgm. of nitrogen in 100 cc. of the medium. The addition of various amounts of potassium, sodium, and calcium nitrates increased to a slight extent the amount of nitrogen assimilated.

9) In liquid cultures all three nitrates caused a large increase in the amount of gum obtained by precipitation with acetone.

10) The presence of large amounts of potassium, sodium, and calcium nitrates proved detrimental to the formation of nodules on alfalfa. *B. radiculicola* did not appear to lose its infecting power when grown on media containing varying amounts of sodium and calcium nitrates. Alfalfa seedlings grown in the presence of large amounts of nitrate did not produce nodules when inoculated with a viable culture of *B. radiculicola*. Nitrates in soil cultures prevented the re-formation of nodules once removed and also caused a decrease in the number of nodules already present.

950 - New Coprolite Works in the United Kingdom. — *The Board of Trade Journal*, Vol. C, No. 1118, p. 532. London, May, 2, 1918.

MANURES  
AND MANURING

The Financial Secretary to the British Ministry of Munitions recently stated in the House of Commons that the initial expenditure by his Department on the new coprolite works — on plant, wages, buildings, and railways — was £31 279. The value of coprolites produced to date was negligible, but deliveries were anticipated to commence at the end of April at a rate which would shortly rise to 1 200 tons per week, and that a total production of some 80 000 tons, of a value of approximately £280 000 would be secured.

961 - Effect of Sulphur on Different Crops and Soils (1). — SHEED, O. M. (Kentucky Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No. 4, pp. 91-103. Washington, D. C., October 12, 1917.

There has recently been some discussion as to the importance and supply for plant growth of sulphur in its various compounds in soils and whether or not it may be a limiting element in crop production.

While it is one of the essential elements, the amounts found by the old method of ashing plants were so low in most cases that it was generally assumed there was an abundant supply of its compounds in soils for all crop requirements. More recently, however, it has been demonstrated by improved methods of analysis that most plants contain much more sulphur

(1) See R. 1911, Nos. 1145, 1397, 3730 — 1912, Nos. 780, 1279 — 1913, Nos. 234, 478, 941 — 1914, No. 503 — 1915, Nos. 4, 69, 798, 1280 — 1916, Nos. 150, 729. (*Ed.*)

than was formerly thought to be the case, owing to the fact that in many instances by the old method the bulk of the sulphur was lost on ashing the plant, and therefore was overlooked. The question then arose as to whether there is an ample supplement of sulphur compounds in soils for crop needs and especially for the best growth of those which are now known to have a high sulphur content.

Some investigators contend that, although some soils are low in sulphur, lower in many cases than in phosphorus, this is compensated for by the amount brought down in the rainfall; and as a result it will never be a limiting element in crop production. There are others, however, who maintain that the sulphur brought down in the rainfall will not equal the loss of this element in the drainage. To establish the point whether the application of sulphur compounds may be beneficial for the maximum production of crops high in sulphur when they are grown on soils that are low in this element, numerous experiments have been carried out. The results were in some cases decidedly beneficial, in others indifferent and in still others injurious. In order to avoid the difficulty arising from the use of the element to be tested in combination with others — which makes the results not easy of interpretation — the writer used flowers of sulphur mixed, at the rate of 100 and 200 lb. per acre, with soil to which the necessary fertilising ingredients were added, together with calcium carbonate. Eight surface soils, taken to a depth of  $6\frac{2}{3}$  in., each representing a distinct type in Kentucky and more or less impoverished by cultivation were selected. Soybeans, clover, oats, alfalfa and wheat were grown in the greenhouse on these soils.

The results show that the sulphur increased the production of some crops, had no effect on others, and on some was injurious, depending on the crop and the soil on which it was grown. There was a preponderance of gains, however, from the sulphur application, but these were generally small.

Analyses of some of the crops show that the sulphur increased the total and sulphate-sulphur content of the plant, and the greater the application, the greater the increase. Where sulphur was applied to clover and alfalfa, the excess sulphur in those plants was in the form of sulphate, while in soybeans part of the excess was in another form. In the soybeans which showed an increased sulphur content, no corresponding increased protein content was always found. In five instances out of eight, however, soybeans grown in soil where sulphur was added show an increase in the total weight of protein.

It was found that, of the 16 varieties of field and garden seeds examined — maize, beans, cowpeas, alfalfa, millet, oats, soybeans, wheat, hemp, timothy, rye, tobacco, peas, onions, bluegrass, clover — some, the 10 last, contain sulphates while others, the first 6, do not, but that, on germinating, all except two — maize and clover — form a greater or less amount of sulphate. The highest sulphate content obtained in the ungerminated seed was 0.048 % in clover, and the increase due to germination varied from none, in maize, to 0.035 %, in the onion. There was a slight loss in only one sample, clover.

962 - **An Estimate of the Amount of Fertilisers Required for Food Production in Norway.** — *Tidsskrift for Det Norske Landbruk*, Year XXIV, No. 5, pp. 208-211. Christiania, 1917.

The Supplies Committee of the Norwegian Agriculturists' League has estimated the amount of fertilisers required in Norway for agricultural purposes to assure the food supply of that country for 1918.

In Norway 590 520 tons of grain are consumed annually; on adding the amount required for sowing the total annual amount is 659 414 tons. The annual production of grain is 344 312 tons, but it could be increased to 413 364 tons by raising the yield per acre from 13.5 to 16 cwt. There would thus be a deficit of 246 050 tons, which could be provided for (assuming a yield of 16 cwt. per acre) by bringing another 620 246 acres under cultivation to cereals, the area requiring a complete fertiliser. On the other hand, increasing the annual production by 69 052 tons would require enough fertiliser for 74 133 acres over and above the area already under cereals, so that a complete fertiliser would be required for  $308\,887 + 74\,133 = 383\,020$  acres.

Assuming that the complete fertiliser would be made up, per acre, of 134 lb. calcium nitrate with 15 % of nitrogen, 178 lb. of 16 % superphosphate and 89 lb. of potash salts containing 37 % of potash, the amount of fertiliser required to produce sufficient food to balance the production and consumption in Norway would be: — 200 039 tons of nitrogenous manures calculated as 15 % calcium nitrate; 3 051 tons of phosphatic manures calculated as 16 % superphosphate; and 15 255 tons of potassium salts containing 37 % of potash.

Normally there are 1 294 866 acres of meadowland. If the area required for cereals is subtracted from that figure, there will remain 988 440 acres of meadowland. The fertiliser required per acre will be 178 lb. of nitrate, 89 lb. of superphosphate, and 89 lb. of potash salts, which gives a total of 39 368 tons of calcium nitrate with 15 % nitrogen, 19 684 tons of phosphatic manures reckoned as 16 % superphosphate or basic slag, and 19 684 tons of 37 % potash salts.

To this estimate of the fertiliser requirements for 1918 must be added the average consumption of previous years, which, according to the statistics consists of 8 858 tons of 15 % calcium nitrate, 41 336 tons of 16 % superphosphate or basic slag and 6 988 tons of 37 % potash salts.

Summing these figures the total fertilisers required in Norway to provide for food production is 70 862 tons of 15 % calcium nitrate, 91 531 tons of 16 % superphosphate, and 41 336 tons of 37 % potash salts.

963 - **Plants Tolerating Salt.** — FENZI, E. O., in the *Bollettino della R. Società Toscana di Orticoltura*, Year XLIII, Nos. 5-6, pp. 37-39. Florence, 1918.

Salt soil and brackish water are found in South Italy and in all the larger Italian islands along the coast of Tripoli, Eritrea and Somalia. So that these soils may be cultivated the author publishes the following list compiled partly from investigations recently made in Algeria by M. J. BRICHET and partly from his own experiments: —

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

1). — PLANTS WHICH DO WELL IN SOILS FREE FROM CHLORIDES EVEN IF THEY ARE IMPREGNATED WITH WATER CONTAINING MORE THAN 1.5 % OF SALT (SODIUM CHLORIDE).

a) Agricultural and industrial plants. — Cotton, *Medicago arborea*, maize, sorghum (*Sorghum* spp.), tobacco.

b) Vegetables, etc. — Sorrel, garlic, beet, white beet, artichoke, cardoon, carrot, various kinds of cabbage, chicory, onion, water melon, bean, various kinds of lettuce, aubergine, capsicum, pea, tomato, leek.

c) Fruit trees. — Apricot from seed or ungrafted, quince *id.*, almond *id.*, apple *id.*, olive, pear ungrafted, plum *id.*, vines of different varieties.

d) Flowering and ornamental plants. — *Achyranthes*, *Ageratum*, amaranth of different varieties, *Antirrhinum*, *Coreopsis*, *Dahlia*, *Datura* of different varieties, *Escholzia*, marigold (*Calendula*), *Gaillardia*, *Gazania*, *Geranium* and *Pelargonium* of different varieties, *Iris* of different varieties, sunflower. *Mirabilis*, *Lippia repens*, camomile (*Anthemis*), *Mesembryaceae* of different varieties, poppies *id.*, *Petunia id.*, stock *id.*, *Zinnia id.*

e) Flowering and shade trees. — Laurel (*Laurus nobilis*), bitter orange, *Acacia eburnea* (= *A. horrida*), *Buddleia madagascariensis*, *Casuarina* of different varieties, *Cestrum elegans* and other species, *Duranta Plumieri*, *Muehlenbeckia platyclada*, *Robinia Pseudoacacia*, *Schinus Molle*, *S. terebinthifolius*.

II. — PLANTS CAPABLE OF GROWING AND DOING WELL IN SOILS CONTAINING NOT MORE THAN 5 % OF CHLORIDES, EVEN IF IMPREGNATED WITH WATER CONTAINING NOT MORE THAN 3 % OF CHLORIDES. — *Aberia caffra*, *Acacia cyanophylla*, *A. cyclopis*, *A. Farnesiana* and other species, *Ailanthus glandulosa*, locust tree, (*Ceratonia siliqua*), *Caesalpinia Gilliesi*, *Cupressus funebris*, *C. macrocarpa*, *Eucalyptus cornuta*, *E. robusta* and other species, *Pittosporum Tobira* and other species, *Pistacia atlantica*, *P. Lentiscus*, *P. Terebinthus*, *Parkinsonia*, *Phillyrea*, *Pinus halepensis*, *Punica Granatum*.

III. — PLANTS CAPABLE OF LIVING AND DOING WELL IN SOIL CONTAINING UP TO 5 % OF CHLORIDES, EVEN IF IMPREGNATED WITH WATER CONTAINING THE SAME PROPORTION OF CHLORIDES. — *Agave americana* and many other species, *Artemisia arborescens* and other species, *Atriplex Halimus*, *A. lentiformis* and other species, *Bupleurum fruticosum*, *Grithum maritimum*, *Juniperus macrocarpa*, *J. phoenicea*, *Melaleuca hypericifolia* and other species, *Myoporum laetum*, *id.*, different varieties of rose bay, *Opuntia Ficus-indica* and other species, *Phoenix canariensis*, *Ph. dactylifera*, *Pircunia dioica*, *Pinus Pinaster*, *P. Pinea*, *Sabal Palmetta* and other species, *Washingtonia filifera* and other species.

As is seen, the plants of the first group tolerate moderate quantities of salt, those of the second tolerate it in fairly large quantities, and those of the third in very large quantities.

- 964 - **A Physical and Chemical Study of the Kafir Kernel, in the United States** (1).  
 — BIDWELL, G. L., in the *U. S. Department of Agriculture, Bulletin* No. 634, pp. 5 + 1  
 Fig. Washington, April 4, 1918.

The grain of non-saccharine sorghums have hitherto been used almost exclusively for cattle feeding, but now they are used in ever-increasing quantities as a human food and for the preparation of starch and alcohol. For this reason the Bureau of Chemistry of the U. S. Department of Agriculture made a physical and chemical study of kafir kernels, using Dawn Kafir (Dwarf Blackhull) C. I. 340. The tegument of this variety is thin, and the endosperm horny without and starchy within. It is broadly ellipsoid and somewhat flattened on the inner surface. Imagining the kernel to lie on a flat surface, the vertical diameter was called the thickness, the shorter horizontal diameter the width, and the long diameter the length. The averages of 50 measurements were: — *thickness*: — maximum 2.74 mm., minimum 2.16 mm., average 2.46 mm.; *width*: — maximum 3.71 mm., minimum 2.95 mm., average 3.33 mm.; *length*: — maximum 4.57 mm., minimum 3.07 mm., average 3.90 mm.; *weight of 1000 kernels* 23.5 gm., — *Average volume of 1 kernel*, 16.78 mm<sup>3</sup>. The grain is composed of 6.1 % by weight of bran, 10 % of germ, 83.9 % of endosperm, 35 % of which is starchy, the rest horny. The endosperm is surrounded by a very friable, more or less granular layer, very rich in colouring matter, and soluble in ether and chloroform; it contains no tannin. The distribution of various components of the different parts of the grain, expressed in percentages of the total quantity of each component (the germ, bran and endosperm respectively) in the whole grain is as follows: —

Ash, 77.9, 7.2, 14.9; ether extract, 75.2, 9.9, 14.9; crude protein, (N × 6.25), 15.5, 2.3, 82.2; crude fibre, 19.1, 49.7, 31.2; nitrogen-free extract, 4.1, 5.5, 90.4.

The corresponding parts of kafir and maize kernels resemble each other in composition and appearance; it may, therefore, be assumed that kafir could be used as a substitute for maize.

- 965 - **Two New Vegetable Globulins:— Stizolobin and the Globulin of Buckwheat.**  
 — I. JOHNS, C. O. and FINKS, A. J. (Bureau of Chemistry, U. S. Department of Agriculture), Stizolobin, the Globulin of the Chinese Velvet Bean, *Stizolobium niveum*, in *The Journal of Biological Chemistry*, Vol. XXXIV, No. 2, pp. 429-438 + 13 Tables + Bibliography of 4 Publications. — II. JOHNS, C. O. and CBERNOFF, I. K., The Globulin of Buckwheat, *Fagopyrum esculentum*, *Ibid.*, pp. 439-445 + 6 Tables. Baltimore, May, 1918.

Chinese Velvet Beans (*Stizolobium niveum*) are being grown in ever increasing quantities in the United States, and, in 1917, covered an area of more than five million acres in the South, an increase of over 100 % of the area cultivated the preceding year. They are used especially as a cattle food, and contain 26.43 % of protein (N × 6.25). By extraction with a sodium chloride solution, and separation by dialysis or precipitation with ammonium sulphate, the authors obtained a globulin which they called

(1) See also R., April, 1918, No. 444. (Ed.)

"stizolobin". The amino-acid content of this globulin determined by VAN SLYKE's method was:—Cystine, 1.20; arginine, 6.72; histidine, 2.65; lysine, 8.27. The lysine content is very high. Stizolobin also contains tryptophane. Analyses of various samples of this globulin by the method mentioned above gave the following percentages:—Carbon, 53.03%; hydrogen, 7.05; nitrogen, 16.33; sulphur, 0.56; oxygen (by difference), 22.94%.

II. — By the method already described (extraction with a solution of sodium chloride, etc.) the authors isolated from buckwheat flour (*Fagopyrum esculentum*) a globulin containing basic amino-acids in the proportions given below according to VAN SLYKE's method:—Arginine, 12.97%; histidine, 0.59%; lysine, 7.90%; cystine, 1.00%. Like stizolobin this globulin is remarkable for its high lysine content, and also contains tryptophane. Several analyses gave the following average percentages for the various constituents of the globulin:—Carbon, 51.69; hydrogen, 6.90; nitrogen, 17.44; sulphur, 1.16; oxygen (by difference), 22.81.

966 — **The High Calcium Content of Some Cucurbitaceous Vines.** — WILKINS, L. K., in *New Jersey Agricultural Experiment Station Bulletin* 310, pp. 20 + Bibliography of 50 Publications. New Brunswick, N. J., April 16, 1917.

In this bulletin data are presented concerning the calcium content of the vines and fruits of some of the cucurbitaceae: namely, pumpkins, preserving citrons, squashes, cucumbers, and cantaloupes. The percentages of N,  $P_2O_5$ ,  $K_2O$ , and  $MgO$  for these cucurbitaceae are also recorded. Furthermore, the crop yields and the removal of plant-food on an acre basis are reported.

The vines were found to have a very high content of calcium, higher than has usually been reported or was believed to exist in most plants. In nearly every instance the mature vines contained calcium at the rate of over 5% of  $CaO$ , rising to as much as 8.75% in one instance.

The amount of calcium in the vines varied at different stages of growth. The tendency was towards an increasing percentage from the early to the later stages of development. In no instance was it less than 3% of  $CaO$  at the first stage taken, nor did it often fall below 6% at the last stage.

The calcium content of the cucurbitaceous fruits was low. In fact, in no instance did it reach as high as 1%. The seeds of the fruits were still lower in calcium, averaging less than 0.25% of  $CaO$ .

In a comparison with the content of N,  $P_2O_5$ ,  $K_2O$ , and  $MgO$ , the percentage of  $CaO$  was almost invariably higher than that of any of these materials in the case of the vines. With the fruits the  $CaO$  percentage was in every instance lower than the percentage of N and  $K_2O$ , and frequently lower than  $P_2O_5$ , but usually higher than the  $MgO$  percentage.

The fact of an increase, as the plants approach maturity, of the  $CaO$  content in the vines attended by a low percentage of  $CaO$  in the fruits, when associated with the fact of a decrease, as the plants approach maturity, of the N,  $P_2O_5$ , and  $K_2O$  content in the vines attended by a relatively high percentage of the same in the fruits, would suggest that a relation

exists between calcium and one or all of these substances in the life processes of the above cucurbitaceae.

On an acre basis the weight in pounds of the CaO content of the vines was found to be much greater, as a rule, than that of the N,  $P_2O_5$ ,  $K_2O$ , or MgO content. The largest amount of CaO was 165.95 lb. in the case of the Yellow Crookneck squash. The largest quantity of any of the other substances was 70.93 lb. for  $K_2O$ , likewise for the Yellow Crookneck squash.

With the fruits the weight in pounds on an acre basis showed the CaO content to be low — exhibiting a tendency toward the reverse of the results obtained with the vines. The largest amount of CaO was 10.06 lb. for the preserving citron fruits. The highest for the other substances was 62.17 lb. of  $K_2O$  for the cantaloupes.

Taking the entire crops, vines and fruits together, on an acre basis, the content in pounds was found in the majority of cases to be greater for the CaO than for any one of the other substances N,  $P_2O_5$ ,  $K_2O$ , or MgO.

967 — **Inulin in the Sunflower-Jerusalem Artichoke Graft** (1). — COLIN, H. and TROUARD RIOLLE, Y., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 856-858. Paris, May 27, 1918.

By grafting reciprocally Jerusalem artichoke (*Helianthus tuberosus*) and sunflower (*H. annuus*) and then analysing the stems above and below the incision, it was found that at whatever level the scion is inserted in the stem and whether the graft be sunflower on Jerusalem artichoke or Jerusalem artichoke on sunflower, there is always, on both sides of the incision, a discontinuity in the polarimetric sign of the soluble carbohydrates in the scion and the stock. The resulting rotatory power is always positive in the sunflower and negative in the Jerusalem artichoke. Inulin is never found in the sunflower. It would, therefore, seem that:—

1) The inulin of the Jerusalem artichoke never enters the sunflower used as stock, or, at least, is very rapidly transformed;

2) Jerusalem artichoke on which is grafted a sunflower scion still forms inulin, not only in the tubers, but throughout the stem, at the expense of the dextrorotary sugars which it derives from the scion.

968 — **Reactions of the Phosphorus of the Thickened Root of the Flat Turnip.** — HARTWELL, B. I., HAMMET, F. S. and WESSELS, P. H. (Agricultural Experiment Station of the Rhode Island State College), in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 359-370, Bibliography of 11 Publications. Washington, D. C., November 19, 1917.

In earlier publications of the Rhode Island Agricultural Experiment Station (*Bulletin* 154; 18th *Annual Report* 1904-1905, pp. 253-285) it was shown that the percentage of total phosphorus in flat-turnip roots (*Brassica rapa*) grown in different soils generally varied in the same direction as the variation in the amount of phosphorus which was available to the plant.

In this paper is recorded the work undertaken with the object of ascer-

(1) See R., April, 1918, No. 399. (Ed.)

taining whether the amount of any portion of the phosphorus of the turnip root is correlated more nearly than the total phosphorus with the relative amount available in soils.

Preliminary indications were derived from the successive extraction of dried turnips with ether, alcohol, and 0.2 per cent hydrochloric acid; but, since it was next found that larger amounts of phosphorus could be extracted from fresh than from dried turnips, all subsequent observations were made on fresh turnips.

Coincident with the introduction of phosphorus into a nutrient solution in which turnips were growing, the appearance of "inorganic" phosphorus and the disappearance of starch were traced microscopically in the different tissues; whereas upon withholding phosphorus the disappearance of inorganic phosphorus and the appearance of starch were similarly observed. About four-fifths of the total phosphorus of fresh turnips was extracted with water. When the latter was acidulated, somewhat less was secured because of partial precipitation.

Only a small per cent of the extracted phosphorus failed to pass through dialyzers. Different precipitants of inorganic phosphorus were tested as to their ability to recover phosphate added in a standard solution to the dialyzates. The phosphorus in the precipitate formed by adding acetic acid to turnip juice was not in phospho-protein compounds. There was no phytin in the juice. The presence of a phosphatase was not shown.

Although the proportion of inorganic to total phosphorus in turnips was frequently made larger by phosphatic applications to the soil in which they were grown, this was not always shown to be the case by such methods as were used.

In most instances the phosphorus in the juice was so largely inorganic and constituted so large a proportion of the total that the determination of the latter seemed about as useful as of any portion for furnishing indications regarding the relative amount of soil phosphorus at the disposal of the turnip.

**969 - Injurious Action of Magnesium Carbonate on Plants.** — COUPIN, H., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 24, pp. 1006-1008. Paris, June 17, 1918.

On account of its insolubility in water, magnesium carbonate, so common in the soil, is generally considered incapable of any injurious action on plants, and, consequently, of having any influence on the life of plants and on their geographical distribution. Nevertheless, this salt dissolves in small quantities in water containing carbonic acid, as occurs near roots which give off carbonic gas during respiration. In order to investigate the effect of the carbonate thus dissolved the author carried out various germination tests, some in fresh water, some in the same water containing an excess of magnesium carbonate. After a few days in the same environment — darkness and a constant temperature of 24°C — the results were compared.

Apart from a few exceptional cases (e. g. that of stone pine) magnesium carbonate was decidedly injurious to plants but in a manner and to a degree



which varied according to the species. This noxiousness manifested itself: — 1) by decreased length of the main root; 2) by a considerable reduction of the number and size of the rootlets; 3) by black or brown colour of the roots and rootlets; 4) by reduction of the absorbent hairs (when, as is rather exceptional, they form in an aqueous environment); 5) by shorter aerial parts (except in the case of common cress). In no case did magnesium carbonate appear to have any useful effect, at least under the conditions of the experiment.

970 — **Absorption of Nutrients as Affected by the Number of Roots Supplied with the Nutrient.** — GILE, P. L. and CARRERO, J. O. (Porto Rico Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. IX, No. 3, pp. 73-95 + 22 Tables + 2 Figs., + Bibliography of 13 Publications. Washington, D. C., April 16, 1917.

In the course of several investigations on the mineral nutrition of rice (*Oryza sativa*) it became necessary to know whether the plant could absorb an optimum amount of the mineral element which was supplied to only part of the roots if all the other essential elements were supplied to all the roots. At first thought it would seem that the plant could absorb sufficient of the element supplied to only part of its roots if sufficient selection could be exercised in the absorption of the different nutrients by individual roots. So far as known, no quantitative study has been made of this point; and the tests reported in the article under review were carried out for this reason. The present work does not deal with the effect of the medium on selective absorption by roots, but with the effect of localization of the supply.

The absorption of nitrogen by rice and maize and of phosphorus, potassium, and iron by rice was tested in water cultures, one-half the roots being maintained in a nutrient solution lacking one of these elements. Tests were also made, varying the portion of roots in the complete and incomplete solutions.

The results show that, under the conditions described, the plant does not absorb a maximum amount of the element, and the fewer the roots supplied with the element, the smaller the total amount absorbed. This applies when the total amount of the element supplied is equal to or in excess of the needs of the plant. A curve was plotted showing approximately what portion of the maximum absorption can be expected with any fraction of the roots supplied with the element. With nitrogen and phosphorus the total amount absorbed by plants with half their roots in the complete solution was 0.76 of that absorbed by plants with all their roots in the complete solution. The similar figure for potassium or iron was 0.66. Increasing the concentration of the element in question in the complete solution did not appreciably alter the results.

The amount of the element absorbed per gram of roots increased greatly as the number of roots in the complete solution was diminished. The results are explained on the basis of the rate of utilisation and transference of the elements in the plant. Attention is called to the bearing of these results on the method of applying fertilisers. The results obtained agree with MITSCHERLICH'S formulation of the law of minimum.

- 971 - **The Formation of Nitrites from Nitrates in Aqueous Solution by the Action of Sunlight, and the Assimilation of the Nitrites by Green Leaves in Sunlight.** — MOORE, B., in the *Proceedings of the Royal Society, Biological Sciences, Series B*, Vol. 90, No. B 627, pp. 158-167 + Bibliography of 8 Publications. London, June 1, 1918.

The thermo-chemical studies of FAURE, THOMSEN and BERTHELOT have shown that the reactions during the formation of different oxides of nitrogen are endothermic. This is also true of the reaction during the formation of nitrites from nitrates, which can only occur by the transformation of other forms of energy (such as that of light) into chemical energy. The author's studies showed that dilute solutions of nitrates exposed either to the sun or to rays from a source of light rich in light-energy of short wavelength, are transformed into nitrites. This is a case of endothermic photo-chemical reaction similar to that concerned in the synthesis of starch in the presence of chlorophyll and sunlight. If a layer of glass is interposed between the source of light and the solution of nitrates, transformation is greatly retarded. This shows that the most active rays are those of short length (ultra-violet). When green leaves are immersed in a solution of nitrates comparatively little nitrite accumulates, the green leaves having the capacity in the sunlight of rapidly absorbing the nitrites thus formed. The author concludes that the nitrates of the soil assimilated by the plant are transformed into nitrites in the presence of sunlight, and that the last phases of the synthesis of nitrogenous compounds take place within the green leaf under the action of this light.

The presence of nitrites and nitrates in atmospheric air cannot be attributed, as many workers have thought, to the action of electrical discharges during storms, because it has never been possible to find any real relation between the nitrate and nitrite concentration of atmospheric air and rainwater on one hand, and frequency of storms on the other. The author observed that freshly-collected rainwater contained as much nitrite (about 0.5 part per million) as rain caught during a thunderstorm. ILIOVAY showed that dew also contains nitrites. The formation of nitrates and nitrites must, therefore, depend on a more constant and evenly distributed factor, such as sunlight, rather than on fortuitous electrical discharges. Rainwater collected for a considerable time contains no nitrites as they have all been oxidised to nitrates, but if it is exposed to strong sunlight or ultraviolet rays nitrites are again obtained.

The nitrites of rainwater and dew are one of the principal sources of nitrogen for plants when the soil has not been enriched with nitrogenous fertilisers. The author, therefore, points out the great importance of the action of sunlight in supplying these compounds so essential to the formation of organic matter.

- 972 - **Choice of Material for Isolating Inflorescences in Selection Work.** — FRUWIRTH, C., in *Zeitschrift für Pflanzengücht*, Vol. V, Pt. 4, pp. 391-395. Berlin, 1917.

The nature of the covers used to isolate the inflorescences is not without influence on the fructification because a certain amount of light may be necessary for the normal development of the seed, especially at

the beginning of setting, as was observed by SCHOLZ for the poppy and LUBIMENKO for the pea and wheat.

The author made similar observations for: — *Triticum sativum* (winter and spring wheats); *Hordeum distichon erectum* and *H. distichon nutans*. *Pisum arvense* and *P. sativum*, *Phaseolus vulgaris*, *Papaver somniferum*, *Arrhenatherum elatius*. During his investigations he used covers of various strength, from parchment bags, which allow the light to pass fairly well, to small wooden boxes lined with black paper used for wrapping up photographic plates. In this last case no seed formed while with the less stiff and opaque covers the number of seeds formed decreased. On the other hand, the amount of light absolutely necessary is not the same for all plants, but varies from one species to another, as is shown by the Table: —

	Black paper bag		Parchment bag		No cover	
	Number of inflorescences	Number of seed formed	Number of inflorescences	Number of seed formed	Number of inflorescences	Number of seed formed
<i>Pisum arvense</i>	5 flowers	0	5 flowers	8	5 flowers	14
Barley Nolča Imperial	5 ears	55	5 ears	94	5 ears	112
Wheat 104 Crieuener	5 "	88	5 "	129	5 "	196

The covers used to isolate inflorescences must, therefore, be fairly transparent as the absence of seeds formed is often attributable to insufficient light rather than phenomena of self-sterility.

973 — **The Selection of Barley in Algeria.** — NICOLAS, G., in *Travaux du Laboratoire de Botanique de l'Université d'Alger*, pp. 1-29 + 5 Plates. Algiers, 1918.

In 1911 the author began a series of experiments with the intention of improving barley in Algeria. He dealt with:— 1) the importation of foreign varieties with well known, stable characters and already selected; 2) reciprocal crosses between Algerian barley, or between Algerian and exotic barleys, in order to fix in a single type any desirable parental characters while eliminating any undesirable ones. Unfortunately the war has interrupted the work, which was already considerably advanced, as will be seen from this article.

**SELECTION OF NATIVE BARLEY.** — In order to ascertain the degree of purity of the samples (100 ears), the well known *polygons of variation* were worked out, considering the most important characters. In this way may be chosen the *density* or *compactness* of the ears, using the formula  $D = 10 \frac{a}{l}$ , where  $l$  is the length of the rachis in centimetres,  $a$  the number of grains in 2-rowed barley and  $\frac{\text{number of grains}}{3}$  in 6-rowed barleys.

Thus in an ear of 2-rowed barley having 52 grains and a rachis 13 cm. long, the compactness will be  $\frac{52 \times 10}{13} = 40$ . If, for 100 ears of a given variety, the following series of values is found:—

Compactness . . . . .	30	31	32	<b>33</b>	34	35	36	37	•
Corresponding number of ears .	0	9	22	<b>34</b>	21	11	3	0	

the average compactness of this variety is 33. If these values are represented graphically, taking those for compactness as abscissae and those for the corresponding number of ears (frequency) as ordonates, the *polygon of variation* is obtained, the summit of which is unique in this case and corresponds to the compactness 33. The existence of a single summit shows that the material has a high degree of purity.

If, on the contrary, the following values are found :—

Compactness . . . . .	28	<b>29</b>	30	<b>31</b>	32	33	<b>34</b>	35	
Corresponding number of ears .	5	<b>15</b>	12	<b>25</b>	20	8	<b>12</b>	3	

the polygon has 3 distinct summits, an evident sign that the barley under question is a very impure mixture of different varieties.

With the help of this method of analysis, the author has examined a very large number of samples from various localities in Algeria, and he has studied their behaviour during the period 1911-14. He thus found that most Algerian barleys are heterogenous mixtures of various forms, from which valuable material could be obtained by selection.

Only 2 barleys, No. 13 and No. 20, remained pure during the whole period of the experiments. The first came from Mecbtas, near Boghni, at an altitude of 1594 ft.; the author has selected two initial varieties —  $\delta$  and  $\beta$  — from it; the latter (*Hordeus hexastichon pallidum*  $\beta$ ) remained pure up to 1914, as is shown by the values :—

Compactness . . . . .	26	27	28	<b>29</b>	30	31	32	33	34
Corresponding number of ears .	3	10	18	<b>28</b>	20	12	5	3	1

IMPORTATION OF FOREIGN BARLEYS. — The Swedish (Svalöf) varieties Svanhals, Primus, Hannchen, Chevalier and Prinzess have been tested. The last one gave the best results, especially in fresh clay soils. Thus, at Adélia, it produced 13.54 cwt. per acre from 1911-13. The only defect noticed is a slight degeneration in the quality of the grain; whilst Prinzess barley gives 79.18% of dry extract in Sweden and central France, at Adélia (according to M. PETIT, Director of the School of Brewing at Nancy) the content falls to 72.69 %, but always remaining 2 % higher than that of the native Algerian barleys.

CONCLUSIONS. — 1) The native Algerian barleys represent a mixture of various forms, so that individual selection cannot fail to give positive results.

2) The exotic varieties selected can be introduced into Algeria with the possibility of success, as is shown by the results obtained with Prinzess barley, produced and selected in Sweden, under very different conditions to those in Algeria.

3) The author proposes to extend and continue his work by making a series of crosses; the use of acclimatised foreign varieties and of native types will provide excellent material for the progressive improvement of a cereal so important to Algeria and the surrounding districts.

974 - **Selection of Rice in the Philippines.** — I. GUTIERREZ, M. E., in *The Philippine Agriculturist and Forester*, Vol. VI, No. 5-6, pp. 135-152 + 3 Figs. Los Baños, January-February, 1918. — II. Goco, A. A., *Ibid.* pp. 154-167.

The recent work by JACOBSON on rice and by MENDIOLA on maize may be said to be the only contributions to selection work in the Philippines where the many forms and the lack of uniformity in the types of the cultivated plants offer the breeder abundant material and the possibility of obtaining good results simply by individual selection without the more complicated work of hybridisation. The authors' attempts to improve the native rices by individual selection have met with such success that great hopes are entertained for the future.

I. — **LOWLAND RICES.** — Four Ilocano or bearded rices were studied, namely, 5 893 Ganadc, 5 894 Iray, 5 895 Binalayan and 5 896 Dequet a Bolilising, as well as two Tagalog or smooth varieties, 5 892 Binangbang and 5 891 Binicol. Shortly before harvest about 100 samples of each variety were collected, and the seeds of each plant sown separately in rows which numbered 177. In a series of tables are given the analytical results obtained for the descendants — grain yield, quality of grain, number and length of culms, duration of the vegetative period, degree of uniformity. With few exceptions the grain yield of the selected varieties was much superior to that of the original varieties, there being a difference of as much as 100 % in some cases. There was a tendency to correlation between the productivity, degree of uniformity of the lines and tillering.

In rice, which is essentially self-fertilising, natural hybridation is rare, so that it is interesting to note some cases in which this phenomenon occurred. During his selection work the author found a plant, 5892-0808 Binangbang with seed of varying red colour. The plant was a heterozygote, as was shown by an examination of  $F_1$  (13 plants with white seed, 5 with light red, and 12 with red seed), derived probably from a natural cross between two varieties of Binangbang rice, one with white seed and one with red seed.

II. — **UPLAND RICE.** — The varieties selected were Kinandang Pula, Pinursigue, Inintiw, Kinamaleg, Kinagaykay, Guluyang Pula. The results obtained were: — 1) with simple mass selection the yield was raised from 20.20 cwt. of paddy per acre to 23.62 cwt., even without fertilisers; 2) the descendants of the parents of the same variety differ greatly in productivity, tillering, length of culms, etc., thus allowing individual selection to be carried out successfully; 3) by selecting No. 22 of the Pinursigue variety a yield of 51.32 cwt. of paddy per acre was obtained.

975 - **Apparent Mutations of Colour in the Beetroot Due to the Effect of Vicinity, in Sweden.** — BIRGER, K. (Seed Selection Station of Weibullsholm, Landskrona, Sweden), in the *Zeitschrift für Pflanzenzüchtung*, Vol. V, Part 4, pp. 357-372. Berlin, 1917.

The multiple variations of colour and form repeatedly observed in beets of the same pure line have not yet been satisfactorily explained. According to the author's latest researches these phenomena are simply due to the effect of vicinity for: — 1) the beet has a high degree of auto-

sterility ; 2) its pollen may easily be carried by the wind or insects over as much as 600 yards ; 3) the gauze, muslin and other tissues used to isolate the inflorescences are not sufficiently close-textured to prevent the passage of wind-borne pollen. Cross-pollinisation may thus occur in spite of ordinary precautions and thus produce forms and characters that appear quite new, especially as regards the colour of the root.

The colour is due to 2 pairs of factors : —  $Yy$  and  $Rr$   $Y$  produces yellow, and, together with  $R$ , produces red. White is produced when  $R$  is alone, and also by the simultaneous absence of  $Y$  and  $R$ . Below are shown the results of crossing types each having one of the two factors  $Y$  and  $R$  as homozygotes.

Parents ( $P$ ) . . . . .	$YY\ rr$ (yellow) $\times$ $yy\ RR$ (white).
$F_1$ generation . . . . .	$Yy\ Rr$ (red)
$F_2$	$F_3$
1 $YY\ RR$ (red) . . . . .	Constantly red.
2 $YY\ RR$ (red) . . . . .	Dividing into 3 reds: 1 yellow.
1 $YY\ rr$ (yellow). . . . .	Constantly yellow.
2 $Yy\ RR$ (red) . . . . .	Dividing into 3 reds: 1 white.
4 $Yy\ Rr$ (red) . . . . .	Dividing into 9 reds: 3 yellows: 4 whites (as in $F_2$ ).
2 $Yy\ rr$ (yellow). . . . .	Dividing into 3 yellows: 1 white.
1 $yy\ RR$ (white) . . . . .	Constantly white.
2 $yy\ Rr$ (white) . . . . .	Constantly white.
1 $yy\ rr$ (white) . . . . .	Constantly white.
<hr/>	
or 9 red: 3 yellow:	
4 whites	

On using these gametic formulae to examine the results of one of the many hybridisations studied by the author, it will be seen that many of the chromatic aberrations and variations observed in a pure line can be explained as phenomena due to proximity of the plants.

Thus, for example, the cross No. 8 : — Yellow Intermediate ♀ ( $YY\ rr$ , yellow)  $\times$  Rote Eckendorfer ♂ ( $YY\ RR$ , red) gave an  $F_1$  with 13 individuals having a red root and an  $F_2$  with 365 individuals having a red root and 154 with a yellow root, in the ratio 3 : 1, corresponding to the theoretical values of 389.25 and 129.75. In the  $F_3$  the progeny of the red-rooted individuals should also be red-rooted, or at any rate with red and yellow roots in the ratio 3 : 1 (see the above scheme). This is what actually happens, save for Nos. 3 605 and 3 606, which give an  $F_2$  for the former of 9 reds : 3 yellows : 4 whites and for the latter 3 reds : 1 white. It seems that these two numbers are new crosses produced spontaneously in the  $F_1$  of the cross No. 8.

The white-rooted individuals of the  $F_2$  should produce, in the  $F_3$ , exclusively white progeny ; on the contrary, in many cases red-rooted types appear ; these beets should be considered as due to proximity of the plants.

Among the plants of No. 385 of the  $F_4$ , the author chose 45 with

white roots and planted them in a special plot; at the right moment 15 of them were isolated in the usual way; the other 30 were left to flower in the open air. The results obtained in the  $F_5$  are quite convincing: — out of 360 descendants of plants isolated under hoods, only 4, or 1.1 %, had red roots, owing to the small amount of foreign pollen that had penetrated through the hoods. On the other hand, out of 5458 descendants of the uncovered plants, 314, or 5.75 %, had a red or yellow colour. Three groups can thus be distinguished: — 1) with red variations only; 2) with red and yellow variations in almost equal amounts; 3) with yellow variations only.

The 45 white-rooted plants isolated by the author were on the experiment field of the Weibullsholm Station, at a distance of some 600 yards from a plot of the yellow *Ovoïdes des Barres* beets. If the pollen of the latter variety, could, in spite of the distance and other obstacles, arrive to the beets planted at Weibullsholm, it would be easy to explain the phenomena noted in the  $F_5$  by the aid of the following scheme:

*Mother plant*: — yy RR (white).

*Progeny*: — 25 % yy RR (white); 50 % yy Rr (white); 25 % yy rr (white).

*Ovoïdes des Barres*: — YY rr (yellow).

*Possible combinations between the Progeny and Ovoïdes des Barres*: —

- 1) yR ♀ × Yr ♂ = Yy Rr (red).
- 2)  $\left\{ \begin{array}{l} yR \text{ ♀} \times Yr \text{ ♂} = Yy \text{ Rr (red).} \\ yr \text{ ♀} \times Yr \text{ ♂} = Yy \text{ rr (yellow).} \end{array} \right\}$  in equal parts.
- 3) yr ♀ × Yr ♂ = Yy rr (yellow).

In this case there were 6 descendants with red variants, 10 with red or yellow variants, 3 with yellow variants, and the values found are sufficiently close to those calculated.

976 — **A Further Note on the Genetics of *Fragaria*.** — RICHARDSON, C. W., in the *Journal of Genetics*, Vol. VII, No. 3, pp. 167-170. London, May, 1918.

In continuation of previous work on the genetics of *Fragaria*. (*Journal of Genetics*, Vol. III, No. 3, Feb. 1914), the author gives further results he has obtained with regard to flower colour, double flowers, hairiness of stems and leaves, and sex.

**FLOWER COLOUR.** — As stated in the previous paper (1), the cross pink flowering *vesca* × white flowering *vesca* produced pink flowering  $F_1$ 's. These selfed produced 20 pink, 57 pale pink, 10 white or very nearly white (of the latter at least 3 were absolutely white). Thus the ratio found of 15:1 corresponds well to that calculated: — 81.57 pink to 5.43 white. The excess of white flowers may be due to the difficulty in distinguishing between very light pinks and pure whites.

**DOUBLE FLOWERING.** — The cross double flowering *vesca* × single produced in the  $F_1$  single flowers with occasional extra petals. In the  $F_2$  there were 60 single to 24 double flowers, 37 single to 13 double, or a to-

(1) Summarised in *R.*, June, 1914, No. 513.

tal of 97 single to 37 double flowers. This gives the ratio 3:1, corresponding to the expectation 100.5 single and 33.5 double flowers.

The cross single flowered  $\times$  double flowered produced single in the  $F_1$ . The  $F_1$  generation selfed produced 58 single and 25 double giving a ratio of 3:1 corresponding to the expectation 62.25 single to 20.75 double.

**HAIRY LEAF STEMS AND FRONT OF LEAF.** — The factor "hairy" is dominant as regards the factor "glabrous". In a cross *F. Virginiana*  $\times$  *F. Chilensis* the  $F_1$ 's had "hairy" stems and the front of the leaves was hairy. The  $F_1$ 's selfed produced 32 "hairy" to 10 not "hairy"; 32 leaves were "hairy" and 10 glabrous; with a ratio of 3 to 1 in each case.

**SEX.** — The results of the various crosses are given in the following table.

Crosses		Distribution of sexes in $F_1$	
		Females	Males or hermaphrodites
<i>F. chinensis</i> ♀	$\times$ <i>F. chilensis</i> ♂	26	21
<i>F. chinensis</i> ♀	$\times$ <i>F. Virginiana</i> ♂	18	14
<i>F. Virginiana</i> ♀	$\times$ <i>F. mexicana</i> ♂	20	15
<i>F. Virginiana</i> ♀	$\times$ <i>F. Virginiana</i> ♂	17	16

The total obtained was 183 females to 155 males or hermaphrodites. There is thus a dominance of the female, which seems to fit a 9:7 ratio. The difficulty here is the classification, as an apparently male plant (e g., a *F. Virginiana*) may sometimes set a fruit or seed. This is why the author finds it simpler to group all sterile flowers with the sex to which they appear to belong, and to consider males and hermaphrodites as one sex.

**CEREAL  
AND PULSE  
CROPS**

**977 — Wheat, Yields per Acre and Prices, by States, for the 50 Years 1866-1915 in the United States.** — U. S. Department of Agriculture, Bulletin No. 511, 16 pp. of tables. Washington, February 13, 1917.

The year 1915 completed the first 50 years during which the United States Department of Agriculture has collected annual data on the yield and value of the most important crops in the different States of the Union. The bulletin under review gives the annual figures for wheat from 1866 to 1915. The tables referring to the different States are preceded by general figures for the production in the whole of the United States and six divisions of the country; — 1) *North Atlantic*, including the States of Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey and Pennsylvania — 2) *North Central, East*: Ohio, Indiana, Illinois, Michigan and Wisconsin — 3) *North Central, West*: Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, and Kansas — 4) *South Atlantic*: Delaware, Maryland, Virginia, West Virginia, North Carolina, South Carolina, Georgia and Florida — 5) *South Central*: Kentucky, Tennessee, Alabama, Mississippi, Louisiana, Texas,



Oklahoma and Arkansas — 6) *Far West*: Montana, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Idaho, Washington, Oregon, and California.

The 10 year averages of wheat yields in bushels per acre for the whole Union and for these 6 divisions respectively were:

	United States	North Atlantic	North Central, East	North Central, West	South Atlantic	South Central	Far-West
1866-1875 . . . .	11.9	13.7	12.2	13.5	8.4	8.5	15.7
1876-1885 . . . .	12.3	14.1	13.9	12.0	8.9	8.0	14.1
1886-1895 . . . .	12.7	14.2	13.8	12.4	8.8	9.6	14.2
1896-1905 . . . .	13.5	16.2	13.4	13.1	10.8	11.6	17.3
1906-1915 . . . .	15.0	18.1	16.3	13.6	13.0	12.4	22.4

978 - **Cultivation of Manitoba Wheat in Touraine, France** (1). — SCHREIBAU, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 528-530. Paris, May 15, 1918.

The author gives the following conclusions deduced from an investigation made by M. MARTIN (Director of the Agricultural Department of Indre-et-Loire):—In the least successful experiments Manitoba wheat gave 7 to 11.92 cwt. per acre. Everywhere else the yield varied from 9.54 to 16.72 cwt.; the average might without exaggeration be placed at 11.14 cwt. per acre. These figures are all the more remarkable because the average yield of winter wheat is 8.34 cwt. There is no doubt that 1917 was a very favourable year for wheat growing in that district; May and June were wet and there was no excessive heat in July. In spite of all disadvantages M. MARTIN considers Manitoba wheat excellent for Indre-et-Loire. Thanks to this new variety it will be possible to sow wheat in spring which could not be sown in autumn.

The author shows the extent to which Manitoba wheat is penetrating and spreading in countries where it was totally unknown — Piedmont, Greece, etc. Most of the reports received by the author favour its cultivation. The fact that some tests have not given the hoped-for results is due to insufficiently sorted seed. To prevent this farmers should ask for 110 to 120 lb. of Manitoba for every 100 lb. of seed to be sown. This wheat is too small to pass through a sorter; it is sufficient to pass it through a 2 mm. mesh sieve to eliminate foreign, broken, or small and malformed grains and obtain excellent seed. In a good lot the waste will not exceed 10 % and may be used for making flour. Failure often results from using too little seed. As Manitoba tillers little 1.59 cwt. per acre should be the smallest amount used. The actual amount must, however, be determined by the farmer, who must bear in mind that it should be sown more thickly than ordinary varieties, and greater quantities be used the later it is sown.

(1) See also No. 1051 of this *Review*. (Ed.)

979 - **Red Clover and its Varieties, in New South Wales, Australia.** — BREAKWELL, E., in *The Agricultural Gazette of New South Wales*, Vol. XXIX, Pt. 2, pp. 105-109 + 1 Fig. Sydney, February 2, 1918.

There are many strains of red clover (some workers recognise as many as thirty) most of which are named after the regions where they were produced. It is impossible to distinguish any difference in the structure of the various strains except in the character of the stem. Thus, the stem of New Zealand Cow Grass and Perennial Red are solid, whereas those of the American strains, such as Giant Hybrid and Broad Red, are hollow. On the other hand the various strains differ in important cultural characteristics, such as duration (1 to 4 or 5 years) and the amount of foliage produced.

The maintenance of a clover pasture is generally considered to depend on the production of self-sown seed and the setting of seed due to pollination by bumble-bees. These insects do not exist in New South Wales and some years ago an unsuccessful attempt was made to introduce them there. At the Yanco Experiment Farm it was found that of 20 heads of flowers examined, more than 80 % of the flowers had not set seed. In 1917 at the Glen Innes Experiment Farm it was found that a plot of Chilean clover had produced 250 lb. per acre, a very fine crop. Among the insects visiting the plants Italian bees were very plentiful at Glen Innes, butterflies and ants at Yanco. Clover pastures lasting many years are common in New Zealand as a result of harrowing in the seeds dropped from the plants from time to time. This method has been adopted at Glen Innes.

The varieties grown in New South Wales are:— Cow Grass, Perennial Red (the two most largely grown), Giant Hybrid Red, Broad Red, American Red and Chilean Red. The yields are usually good, and at Glen Innes very high ones have been obtained. Chilean Red Clover was first introduced by the Hawkesbury Agricultural College; in the experiments at Hawkesbury and Glen Innes, Yanco, Grafton and Bathurst Experiment Farms as well as in those made by farmers, it always surpassed all the other varieties previously tested. Its principal characteristics are:— permanence, resistance to drought and frost and heavy yield (at Glen Innes in 1916, 4 tons 5 cwt. of hay per acre). The New South Wales Department of Agriculture is undertaking the supply of acclimatised Chilean clover seed, among which there are practically no hard seeds, difficult to germinate. The vitality of the seed in seven days was over 90 %.

980 - ***Enneapogon mollis* in Ascension Island.** — STAFF, O., in *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 217-219 + 1 Photograph. London, 1917.

In Ascension Island, formed of barren volcanic matter, except for one peak with scanty endemic vegetation, a new wild grass, identified at Kew as *Enneapogon mollis* Lehm (= *Pappophorum molle* Kunth.) appeared unexpectedly in 1917. This plant transformed stretches of previously desert land along the coast and in the plains (it also grows in brackish places) into large green meadows. Where the soil is best it grows to a height of 3 feet.

It appears to be an annual and is found particularly in tropical desert

districts such as that described, on the coast of Angola, in Great Namaqualand, from whence it extends through the Kalahari Desert to Bechuanaland and Griqualand. It has also been found in the Sudan, Abyssinia, Eritrea, and Somaliland, Madagascar, and, on one occasion, in the Punjab.

Nothing definite is known of its value as a fodder plant, but there is no doubt that it would be very important as such in all arid countries. As a similar plant is mentioned *Schmidtia bulbosa* Stapf of North Rhodesia, a perennial, very nourishing grass, suited to the same conditions as *Enneapogon mollis*, the cultivation of which in Ascension Island is recommended if it will succeed there.

981 - **Experiments on Steppe Pasture in the Dehesa de Nuestra Señora del Pilar, the Central Steppe of Spain.** — ESTEVE, F., in the *Revista de Montes*, Year, XLI, Nos. 970 to 976, pp. 423-429, 472-476, 512-515, 559, 585-593, 665-666. Madrid, June to September, 1917.

The Dehesa (pasture land) de Nuestra Señora del Pilar, at Caracena del Valle (municipality of Castillejo del Romeral, province of Cuenca), at an altitude of from 2 624 to 3 608 feet, is an estate of 4 940 acres,  $\frac{2}{3}$  of which are wood and pasture land. Whereas this estate could previously feed a fairly large number of cattle, at the time the author began to improve it could barely support 1 000 sheep, which had to be given fodder during a great part of the year. According to the author the gradual deterioration of pasture land occurs as a general rule in Spain, and is due to the fact that nothing is done to renew it, so that the pasture grass gradually gives place to weeds, which the animals refuse. The result is that, though a century ago Spanish stock breeding occupied one of the first places in the world, Spanish pasture-land today can with difficulty support 27 lb. of live weight per acre as compared with 450 lb. in some countries where intensive cultivation is practised. While the author was improving the estate in question Dr. E. REYES' important work, *Las estepas de España y su vegetación*, was published. This work decided the author to extend his research and to investigate the problem of the improvement of mountain pasture-land in Spain. The investigations include: — 1) Pure seeds, *i. e.*, the use of commercial seed belonging to a single botanical species under various conditions, with a study of the habit of growth and the quality and quantity of the product, the age at which the plant begins to produce and that in which it is producing fully, its economic duration, acclimatisation, etc.; 2) Experiments in improvement by cultivating forage crops on the central steppe; 3) Experiments with different seed mixtures; 4) re-planting and cultivation of the mountain pasture-land of Nuestra Señora del Pilar; 5) a study of the bushes and trees growing on these pastures, and the acclimatisation of these plants. A table shows the numerous species used as pure seed, giving for each one: — the agricultural value (product of *purity* by the *germinating capacity*, expressed in per cent); the amount of seed required per acre; whether the species in question does or does not belong exclusively to the flora of the steppes. The basis of the various mixtures of forage seed used

were; 1) dry-land alfalfa; 2) sainfoin; 3) clover. For example, in 1916, a dry year in which the seeds were very late, two cuttings of Group 2, gave the following yields of green forage per acre: — mixture of 85 % of sainfoin (*Onobrychis sativa* var. *bifera*) + 15 % of tall oat grass (*Arrhenatherum elatior*) 11.15 cwt. of forage; mixture of 45 % of sainfoin + 55 % of great burnet (*Poterium Sanguisorba*), 66.90 cwt.; mixture of 70 % of sainfoin + 30 % upright brome grass (*Bromus erectus*), 49.38 cwt.. For each seed the author determined the percentage of the "supplement" or amount of extra seed to be used for the mixture as compared with the amount required for pure seed.

Judging by the vegetation of the various plots, alfalfa does best with cocksfoot (*Dactylis glomerata*). With this grass wild alfalfa (*Medicago sativa* var. *sylvestris*) produces more than when sown with great burnet. Mixtures with a basis of Provence alfalfa gave more forage than those of wild alfalfa. Sainfoin and great burnet do well together, especially for pasture land. The mixture sainfoin + tall oat-grass produces yet more, and the mixture sainfoin + brome grass is good in poor, dry soils. Of the mixtures with a basis of clover those with red clover (*Trifolium pratense*) gave the best results; those with a basis of white clover (*T. repens*) also did well, but those with a basis of Swedish clover (*T. hybridum*) did not give good results. Timothy (*Phleum pratense*) was the grass which did best with red clover.

On a plot prepared for irrigation various species were grown in lines 8 1/2 inches apart for the production of seed. These are only harvested every two years, and in 1916 some of the species were cut. They gave the following yields in green forage per acre: — cocksfoot, 45.16 cwt.; brome grass, 44.60 cwt.; tall oat grass, white clover, bird's foot trefoil, 44.60 cwt each; serradella (*Ornithopus sativus*), scorpion senna (*Coronilla scorpioides*) and crown vetch (*C. varia*) 31.86 cwt. each.

The list of forage plants belonging exclusively to the steppe flora which have been found at Castillejo include: 13 Gramineae, 10 Leguminosae, 1 Liliaceae, 1 Rosaceae, 1 Umbelliferae, 1 Gentianaceae, 1 Convolvulaceae.

#### FIBRE CROPS

982 — **The Time at Which Cotton Uses the Most Moisture.** — McCLELLAND, C. K. (Georgia Agricultural Experiment Station), in the *Journal of the American Society of Agronomy*, Vol. X, No. 4, pp. 185-189 Washington, April, 1918.

It is known that cotton requires less water than a crop of maize or oats, indeed, drought during the period of filling and ripening of the seeds causes a notable reduction in the yield of these cereals, whereas drought during the period of the ripening (opening) of cotton bolls is beneficent. The ripening period of grain, however, corresponds to the blooming (filling) period of the bolls, and drought at this period causes a large number of the cotton buds to drop.

By experiments made in 1915 and 1916 at the Georgia Experiment Station the author determined by means of potometer cultures the amount of water required by cotton during its growth. In each of the 11 weeks (from the 1st week of July to the 3rd week of September) in 1915, 10 plants grown in potometers consumed the following quantities of water respectively

(in litres):—19.4, 77.1, 169.7, 193.7, 285.0, 232.8, 271.9, 293.0, 112.5, 263.0, 150.2. In each of the 10 weeks between that ending July 25 to that ending October 7, 1916, 11 cotton plants in potometers consumed the following number of litres of water respectively:—24.75, 103.50, 157.50, 128.25, 139.50, 85.50, 49.00, 27.00, 85.50, 49.50. From the 1st to the 7th of these weeks the number of flowers opening on the 11 plants was:—0, 33, 44, 105, 85, 74, 42. There appears, therefore, to be a correlation between the period of the highest rate of flower-opening and that during which the plants consume the most water. If this be so, it would be advisable to cultivate the soil sufficiently late for it to conserve its moisture during the summer months, *i. e.*, a little later than is usually done in the United States.

983 - **Zapupe** (1). — *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 239-240. London, 1917.

Zapupe fibre first came into prominence a little more than 10 years ago. In 1907, in the State of Vera Cruz, there were over 5 million plants in various stages of growth. The following three cultivated species have been identified by TRELEASE: — *Agave zapupe* Trel. (local names:— blue zapupe, zapupe azul, zapupe de Estopier, zapupe de San Bernardo of Tuxpan, Vera Cruz); *A. Lespinassei* Trel. (local names:— zapupe de Tepezintla, zapupe de Vincent of Juana, Ramirez and Tuxpan); *A. Deweyana* Trel. (local names:— cultivated green zapupe, zapupe de Huasteca, zapupe de Fantoyuca, zapupe verde of the region between Tampico and Vera Cruz). None of these species are known in the wild state, but TRELEASE distinguishes a fourth, *A. aboriginum* (2), known in the district between Tampico and Vera Cruz as wild zapupe, zapupe cimarrón, zapupe silvestre, zapupe de Sierra Chontla; this is said to be cultivated sometimes. In the *Diplomatic and Consular Reports* (No. 4453, p. 5, Tampico; Washington, 1910) it was stated that in 1909 the planting and cultivation of zapupe continued to attract much attention and that several 3-year old plantations were cleaning and exporting fibre. In 1910, besides the planting done by private individuals, many companies had formed for the cultivation of zapupe (*Ibid.* No. 4665, p. 9, Vera Cruz; Washington, 1911). In 1911 a Belgian syndicate made arrangements for developing this fibre plant in the Vera Cruz district (*Ibid.*, No. 4873, p. 9, 1912). In 1913 it was reported that its cultivation had ceased, and that no fibre had been exported that year (*Ibid.*, No. 5365, p. 15, Tuxpan, Vera Cruz; 1914). A sample of zapupe fibre (species indefinite) from Mexico was valued in 1913 at £ 30 to £ 32 per ton; in the same year sisal fibre realised up to £35 per ton. In countries where the conditions are suited to *Agave* cultivation it is best to grow sisal hemp, which is better known and, which notwithstanding previous statements, is apparently not inferior to zapupe.

984 - **The Mulberry as a Textile-Fibre Plant.** — See No. 1040 of this Review.]

(1) See R. 1911, No. 1744; 1913, No. 938. (*Ed.*) — (2) Five species are described by TRELEASE (*Transactions of the Academy of Sciences, St. Louis*, Vol. XXVIII, 1909), the four mentioned above and *A. Endlichiana selvatica.* (*Ed.*)

CROPS  
YIELDING OILS,  
DYES AND  
TANNINS

985 - "Sélé", "Cocorico" and *Ximenia americana*, African Oil-Yielding Plants.  
— PIERAERTS, J., in the *Annales du Musée Colonial de Marseille*, Year XXV, Ser. 3,  
Vol. IV, (1916), Pt. 2, pp. 1-21. Marseilles-Paris, 1917.

Of the three seeds examined by the author, the first two came from the Belgian Congo and the third from British Africa.

I. SÉLÉ. — The plant known locally by this name appears to be popular among the natives in certain parts of the Belgian Congo. The author examined a specimen from Mowbasa (Bengala district) prepared locally by :— 1) roasting the seed, decortication and winnowing ; 2) disintegration of the kernel by pounding ; 3) separation of the oil by boiling water ; 4) removal of the supernatant oil and clarification by standing and filtration.

The tests made by the author led him to conclude that sélé is essentially composed of a mixture of glycerides of oleic, linoleic, stearic, palmitic and lauric acids. It also contains a small quantity of an acid of a higher molecular weight, which could not be identified owing to the lack of a sufficiently large sample of raw material.

Sélé oil is an excellent edible oil, with an agreeable, sweet flavour, which, if carefully prepared by modern methods, would not have the burnt taste of the sample examined. Its value is increased by its good keeping qualities. It is without any doubt suitable for soap-making, and its relatively high glycerine content should make it much sought after by manufacturers of this product. It is useless for the manufacture of stearin products as its solid acid content is too low. It may be considered as a semi-siccative oil to be classed with cottonseed oil.

II. COCORICO. — This plant is a variety of *Citrullus vulgaris*. Cucurbitaceae with seeds containing fats are widely distributed in many parts of the Belgian Congo. The increasing cultivation of them from year to year is not only due to their easy adaptation to the quality of the soil, but especially to the fact that they need no cultural care. These Cucurbitaceae indeed grow so rapidly and vigorously that they prevent the invasion of weeds. In his paper on native agriculture in the eastern province of the Belgian Congo, THARIN (1) states that, in 1914, there were about 500 acres of oil-yielding Cucurbitaceae among the plantations along the Lokandu-Schuka road alone.

It should be noted that in the Belgian Congo the term "cocorico" has no very precise botanical signification. In the Upper Ituri it is applied to the seeds of a variety of gourd or melon called "maboke" or "n'du" in the Kilendu language, whereas in the eastern province a distinct variety of maboke which ripens more slowly and is said to contain less oil is known as cocorico.

The oil examined by the author was prepared on April 25, 1914 at Yangambi (Stanleyville district) by a method called "arabisée", which is in reality only a variation of the method already described for sélé oil. The only difference appears to be that in the "arabisée" method decortication precedes roasting.

A chemical analysis showed cocorico oil to be a valuable product with

(1) *Bulletin agricole du Congo belge*, Vol. VI, 1915, p. 147.

all the desirable qualities of sélé oil. Cocorico seed contains 37.50 % of oil which, in ratio to the kernel, is 50.46 % of the dry matter content. The cake is rich in nitrogen and would make an excellent nitrogenous fertiliser. So long as it contains no injurious or toxic substances (which is very improbable) cocorico-seed cake would be a valuable food for cattle or poultry, especially if mixed with starch or sugar. The tegument of cocorico seeds contains an appreciable amount of nitrogen and would make excellent composts.

In spite of the unquestionable value of its oil nothing at present indicates that cocorico might form an important export even if modern extraction methods are used and a higher yield obtained. The author considers the low unit yield of cocorico and the difficult and slow decortication of its seed make it useless for commercial purposes. On the other hand the home trade in cocorico oil and that of similar Cucurbitaceae should be encouraged in the Belgian Congo both locally and between the different districts.

III. *Ximenia americana*. — This bush belongs to the Oleaceae family and is usually found in the tropical districts of the old and the new continent. It is particularly abundant in America and the west coast of Africa. Dr. E. HECKEL (1) described in detail the botanical variations of this plant as well as its food value and toxic properties.

The *Ximenia* is known by many local names peculiar to the different countries in which it is found. In Jamaica it is called "mountain plum" or "sea plum", in Gabon, "elozy", "zégué", or "sealemon". In South Africa, whence the sample studied by the author came, it is called "zuur pruium" (acid plum).

The value of the "sea plum" lies particularly in the high oil content of its seed. In all probability the plant will be largely used commercially as soon as it is better known and cultivated more carefully and intensively.

Among the new properties found in it the author draws particular attention to the hexabromide test and the special properties of the solid acids. According to its percentage of bromine derivatives insoluble in ether, *Ximenia* should come immediately after linseed and candle-nut oil in the list of siccative oils, with respect to the linoleic acid content.

The oil extracted from this plant is used by the South African natives to make candles and to anoint their bodies. The fruit is said to make excellent preserves.

986 — *Elaeis Poissonii*, a New Species of Oil Palm, in the Cameroons. — FAUCHÈRE, in the *Bulletin de l'Office Colonial*, Year XI, Nos. 121-122, pp. 80-83. Melun, January-February, 1918.

In a paper sent to the author (Inspector of Agriculture, Secretary of the Council of Colonial Agriculture of the Acclimatisation Society) M. E. ANNET reports the occurrence in the Cameroons of a variety of oil palm, the commercial value of which appears to be very great. M. ANNET has made a new species of this form of *Elaeis* and has dedicated it to

(1) HECKEL, Les graines nouvelles ou peu connues des colonies françaises. Paris, 1898, p. 27. (Author)

EUGENE POISSON, one of the first to study oil palms in Dahomey and who, towards 1903, did much to further the commercial utilisation of the palm. The new species has, therefore, been called *Elaeis Poissonnii*. It is remarkable for its fruit which is enclosed in a sort of fleshy sheath formed by the development of six staminodes contained in the female flower which, in the other varieties of *Elaeis* hitherto described, are always atrophied. The fruit, which is generally fairly large, weighs from 10 to 20 gm.

M. ANNET distinguishes two varieties — var. *tenera* and var. *dura*. A comparison of these two varieties with each other and with the var. *Lisombe* of *Elaeis nigrescens* (the best form of oil palm known at present) gave the following figures with respect to the different parts of the fruit and the yield in oil:—

	<i>Tenera</i>	<i>Dura</i>	* <i>Lisombe</i>
Oily Pulp . . . . .	76 %	44 %	61.5 %
Sheath. . . . .	37	18	
Pericarp. . . . .	39	26	
Nuts . . . . .	24 "	56 "	38.5 "
Shell . . . . .	13	42.6	27.5
Kernel. . . . .	11	9.8	17
	100	100	100
Oil yield of the pulp . . . . .	70.25 %	38.6 %	63.15 %
" " of the whole fruit. . . .	53.50	55.8	38.35

These figures show that it would be of great value to cultivate the *tenera* variety. M. ANNET obtained the following figures for ten fruits of each of the chief varieties of *Elaeis* in the Cameroons:—

	Weight in grams			
	of the fruit	of the pulp	of the kernel	of the oil
Dibope . . . . .	123.0	51.5	23.0	27
Lisombe . . . . .	121.5	76.5	20.5	47
Dura . . . . .	171.0	74.2	18.1	44
Tenera . . . . .	168.5	128.3	19.4	90

987 - The Oil Content, Keeping Qualities and Commercial Possibilities of Para Rubber Seed.—SPRING, F. G. and DAY, F. W. F., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 5, pp. 231-244. Kuala Lumpur, February, 1918.

This paper gives a report of the experiments carried out by the Department of Agriculture of the Federated Malay States and reproduces data previously obtained by the Imperial Institute (1).

A few years ago there were wide areas of land suitable for growing *Hevea*. There was, therefore, a large demand for the seeds, which realised good prices. Now, however, as many of the plantations have come to maturity the production has increased enormously and the demand has greatly decreased, so that the problem of using the seed for other purposes arises. The average production in the Malay Peninsula may be estimated at 306

(1) See R. 1913, No. 1362 and R. 1914, No. 240. (Ed.).



lbs. per acre. In a seven-hour day one child, paid 18 cents a day can collect about 5 000 seeds; 1 000 seeds dried in the sun to constant weight weigh 81b. 6 oz., of which the shells weigh 3 lb. 2 oz. and the kernels 51b. 4 oz.

To test the keeping properties of the whole seed and the husked seed, samples were placed in gunny sacks and in wooden boxes as follows:—

A) *Whole seeds*. — 1) put in sacks the day after being collected; 2) put in boxes the day after being collected; 3) packed in sacks after having been sun-dried for three weeks.

B) *Husked seeds*. — a) shelled after being dried in the sun for 16 days:— 4) put in sacks; 5) put in boxes; b) shelled the day after being collected:— 6) packed in sacks.

The samples of Group 1 were in excellent condition after 4 months and good after having been stored for 6 months. Those of Group 2 varied; one began to deteriorate after 3 weeks, and others were slightly mouldy after 2 ½ months or 4 months; another was in good condition after 6 months. The samples of Group 3 were in excellent condition after 4 months' storing. Those of Group 4 were in good condition after 2 ½ months; one sample was slightly mouldy after 4 months, another had kept well but was infested with insects after 6 months. The seeds of Group 5 were in good condition after 6 months, but those of Group 6 began to deteriorate at the end of 3 weeks and were decayed after 4 months.

Crushing the whole seed of three samples in good condition and extracting with petroleum ether gave:— 51.8 to 53.3 % of oil by weight in the kernel; 23.5 to 31.4 % in the whole seed; 8 to 23 % of acidity (mgm. of KOH per gm. of oil); a sample of decayed seed gave slightly different results — 46.2, 23.2, 34 %. (In all these determinations the limit of accuracy is within 0.5 % only). *Hevea brasiliensis* seeds can, therefore, keep for a fairly long time. The oil yield and composition of good and decayed seeds differ little.

The dried husks contain 0.70 % and the dried kernels 1.83 % of ash, containing respectively 37.8 and 44.8 % of matter soluble in water; 7.9 and 18.6 % of magnesia; 38.6 and 37.2 % of potash; 16.8 and 28.6 % of phosphoric acid. The nitrogen and protein contents are:— 0.22 and 1.39 % for the shells, and 2.45 and 15.3 % for the kernels, respectively. The last figure corresponds to 27.8 % of protein residue in the cake after 45 % of oil has been extracted.

988 — **The Effects of Tapping and Wintering on the Food Reserves of *Hevea*.** — RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie*, No. 1, pp. 1-7 + 3 Plates. Batavia, 1917.

RUBBER, GUM  
AND  
RESIN PLANTS

The author studied the effects of tapping and wintering on the food reserves of *Hevea* in order to solve the following points:— 1) Does not the system of tapping used at present remove a larger quantity of food reserve than the tree is able to store up? 2) During wintering does not the plant draw upon these reserves to such an extent that, in order not to exhaust them, it would be better to stop tapping?

The conclusions of other workers (1) (CAMPBELL and BATESON) on this subject agree. They state that the effects of tapping on the food reserves of the wood and bark are exceedingly slight and limited to the immediate neighbourhood of the incision. On the other hand, the effects of wintering are more serious. The amount of reserve food contained in the wood and bark remains normal till the new leaves begin to develop. About a fortnight later, when the leaves have reached the normal size, the starch in the bark and wood has disappeared to a depth of 5 to 10 mm. For this reason these workers consider tapping should be stopped during the growth of the leaves till one week after the development of the tree's foliage is complete.

The author does not consider this opinion to be well-founded. He calculates the disappearance of the starch in the bark and wood to a depth of 10 mm. to represent a decrease of about  $\frac{1}{6}$  of the total reserve food of the plant, leaving  $\frac{5}{6}$  of this reserve available. Four or six weeks after the development of the leaves the reserves will again be totally replaced. Seeing that tapping only removes very small quantities of starch within a limited radius round the incision, the author does not consider there is any serious physiological reason for stopping tapping during wintering.

989 - **Value of the Results Obtained by the Use of Apparatus for Estimating the Rubber in Latex.** — RUTGERS, A. A. L. and MAAS, J. G. J. A., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubber Serie*, No. 3, pp. 1-24 + 20 Tables. Batavia, 1917.

The authors wished to test the value of the results obtained with certain patented apparatus at present in use for the estimation of rubber in latex, such as DRING and FAGE'S "Metrolac" (2), and GRIFFIN'S "Latexometre". Many workers (ULTÉE, GORTER, etc.) agree as to the small value of determinations obtained thus. The many tables given by the authors and compiled from four series of estimations made with different apparatus by different people confirm this opinion. The results which were in each case checked by weighing the dry samples, showed a deviation between the *actual* values obtained by weighing and by the apparatus, but an agreement in the *relative* values. The use of the apparatus is, therefore, justified in so far as it gives relative and comparative data. The deviations in the absolute values are probably due to faults in setting up the apparatus and to the influence of temperature. As a matter of fact the values found do increase as the temperature rises.

990 - **Bibliography of the Publications on Rubber Which Have Appeared Between 1910 and 1916.** — RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubber-serie* No. 5, pp. 84. Batavia, 1917.

The author considers the publications previous to 1910 especially of historical interest, or of interest only to specialists, and therefore refers only to the work of R. MARZAEN: — "*Wissenschaftliche Arbeiten über Kautschuk, Gutta-percha und Balata*" (published in the *Gummi-Zeitung*, Years I to XXV, Berlin, 1886 to 1910). He also leaves aside all publications of an

(1) See R. 1915, No. 814 and 917. — (2) See R. 1917, No. 1207. (Ed.)

economic or financial character, dealing with commerce, planter's societies, etc. The bibliography under review, therefore, is of interest solely to planters and those who prepare the product, and is drawn up eminently for practical purposes. It is divided into six chapters:— 1) General cultural methods; 2) Preparation, coagulation, vulcanisation; 3) Pathology; 4) Cultivation in various countries — Java, Sumatra, other Malay countries, Ceylon, Brazil; 5) Reports, conferences, miscellaneous; 6) Periodicals.

991 — **Measurement of the Growth of Sugar Cane; Observations Made in the Dutch East Indies.** — KUYPER, J. (Inspecteur der Cultuuraafdeeling te Pasoeroean), in the *Archief voor de Suikerindustrie in Nederlandsch-Indië*, Year XXVI, No. 5, pp. 163-165 + 9 Tables + 25 Diagrams. Soerabaja, January, 1918

SUGAR CROPS

To measure the growth in height of sugar cane the author uses a specially constructed apparatus consisting of a high, square, wooden rule graduated in centimetres fitted with a slider to which is attached a small copper plate graduated in millimetres.

The numerous measurements made by the author and given in the form of diagrams, show that the time between the appearance of two successive shoots varies between 5 and 7 days for the local varieties observed. Night growth usually exceeds day growth, but the latter is much influenced by rain, which may cause a day growth superior or equal to night growth. The moisture content of the air has practically no influence, or only very rarely has any perceptible effect.

992 — **Analysis of "Cocoa Tea", a New Substitute Used in Great Britain.** — BAKER, J. L., and HULTON, H. F. E., in *The Analyst*, Vol. XLIII, No. 507, pp. 189-197 + 4 Tables. London, June, 1918.

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

The present war conditions have stimulated research for substitutes of all kinds. One of the most recent which it has been attempted to introduce into Great Britain is a beverage made from cacao shell which remains after the seed has been roasted. This substitute is known as "cocoa-shell tea".

The data published on this residue and the attempts made to utilise it are rapidly reviewed. They show that beverages made from this material are not very highly valued, nevertheless these shells have recently been put on the market at prices out of all proportion to their food value, which has been exaggerated. The authors consider this matter should be remedied, and that the use of cacao shells cannot be objected to so long as they are sold at a reasonable price in conformity with their food value. The results of the analysis of several samples are given in the tables; the average figures are:— Moisture 4.68 %, fat 3.56 %, total ash 10.52 %, nitrogen 2.42 %, crude protein ( $N \times 6.25$ ) 2.42 %, crude fibre 15.42 % matter soluble in cold water 21.0 %. The content in matter soluble in hot water was also estimated to determine the practical value of the substitute. A mixture was made by boiling 3 parts of cacao shell with 100 parts of water and then straining. The figures obtained were higher than those for the content in matter soluble in cold water. This was partly due to the fact that a certain quantity of matter in suspension passed through the strainer.

993 — Trials with Réunion Tobacco in Mauritius, in 1916-1917 — AUCHINCLECK, G. G., in the *Department of Agriculture, Mauritius, General Series, Bulletin* No. 9, pp. 12. Port Louis, 1917.

In Mauritius there is a large importation and consumption of Réunion tobacco (chiefly used for strong cigarette tobacco). Owing to this, cultivation tests of this variety have been started in the Pamplémousses Botanic Gardens and in two other localities in the island, on a total area of about  $3\frac{1}{4}$  acres. The results were completely satisfactory; from 195 992 sq.ft. 535 carottes of 11 kg. each were obtained. No verdict can as yet be given as to the quality of the tobacco, as the special preparation necessary requires from 18 to 24 months.

The Réunion tobacco called "tabac bleu" is notable for its uniform foliage and growth (probably resulting from prolonged selection) and, so it appears, a greater resistance to diseases and pests than that of the Virginian, Sumatra and Turkish tobaccos so far tested at Pamplémousses.

994 — Medicinal Plants of the Italian Colonies. — *L'Agricoltura coloniale*, Year XII, 1st Half Year, No. 1, pp. 54-56. Florence, March 21, 1918.

Towards the end of January, 1918, the MOLTENT chemical-pharmaceutical company asked the *Agricoltura coloniale* for a list of the medicinal plants of the Italian colonies in order that the pharmaceutical produce to be obtained from them might be studied. The *Agricoltura coloniale* immediately wrote to the agricultural departments of Tripoli, Bengasi, Asmara and Mogadiscio asking for information on the native plants of the colonies which might best be cultivated for medicinal purposes. The Royal Agricultural Department of Tripoli sent the following list:—

1) Plants already widely grown in Libia or the cultivation of which could be introduced or increased:—

*Cupressus sempervirens*, *Mirabilis Jalapa*, *Lepidium sativum*, *Papaver somniferum*, *Nigella arvensis*, *Rosa* sp., *Acacia Farnesiana*, *Poinciana Gilliesii*, *Trigonella Foenum-graecum*, *Punica Granatum*, *Lawsonia alba* (the measures adopted by the government to suppress adulteration have given good results), *Coriandrum sativum*, *Cuminum Cuminum*, *Zizyphus Spina-Christi*, *Ricinus communis*, *Nerium Oleander*, *Hyoscyamus* sp.

It would probably be possible to grow successfully:—

*Glycyrrhiza glabra* and *Myrtus communis* in Cyrene; *Cassia obovata*, *Sinapis nigra* and *Datura Stramonium* in Tripoli.

2) Wild plants of the coastal districts which by reason of the present political situation can be harvested and utilised:—

*Juniperus phoenicea* (Cyrene), *Asphodelus microcarpus*, *A. pendulinus*, *Urginea maritima*, *Cynomorium coccineum*, *Atriplex Halimus*, *A. mollis*, *Polygonum equisetiforme*, *Papaver Rhæas*, *Adonis microcarpus*, *Thapsia garganica* (Cyrene), *Peganum Harmala*, *Malva sylvestris*, *Calotropis procera*, *Solanum villosum*, *Withania somnifera*, *Ajuga Iva*, *Citrullus Colocynthis*, *Diotis maritima*, *Matricaria aurea*.

3) Useful wild plants which, on account of the present political situation, cannot be harvested:—

*Callitris quadrivalvis*, *Cornulaca monacantha*, *Aihagi maurorum*, *Balanites ægyptiaca*, *Halophyllum vermiculare*, *Thymus capitatus*, *Globularia Alyssum*, *Artemisia Herba-alba*.

995 - Pine-Apple Growing in the Azores. — LUZ, T., in *Bioteria*, Pt. 3, pp. 123-127 + 2 Figs. Braga, 1918.

FRUIT  
GROWING

As the climate of the Azores does not permit the growing of pine-apples in the open they have been grown in greenhouses since the beginning of the 19th century in the islands of San Miguel and Terceira. In the second island exportation has practically ceased since the last thirty years or so, and the few pine-apple greenhouses left are used almost exclusively for local requirements. In the island of San Miguel, on the other hand, there are about 3 000 greenhouses which supply a large export trade.

The San Miguel greenhouses are double, about 165 feet long and 34 feet wide, and are built of wood and iron, covered with glass. An aisle leads up the centre, separating two beds raised slightly above the level of the soil. Propagation is by cuttings after the fruit has been gathered and the leaves removed. When the surface layer of soil has been removed a layer of clean dry leaves is laid down, over which is thrown another layer of the previous year's soil, in which the cuttings are placed; these are in their turn covered with a layer of new, good quality humus. When the leaves ferment they produce much heat which causes the cuttings to germinate. When the new shoots are four months old they are separated from the cuttings and planted, in squares at intervals of 1 foot in another greenhouse where the beds have been prepared as in the first one. After seven or eight months they are transplanted in the final greenhouse, prepared as the other two, in squares at intervals of 20 to 24 inches. Five months after transplanting fumigation is carried out. Dry straw and bits of plants are burnt in the central aisle and for three days the greenhouse remains full of the smoke produced. One month after this fumigation the plants flower all together and the fruit ripens at the same time, thus leaving the house free immediately after the harvest. Two years elapse from propagation to the harvest — five months in the nursery, seven in the first hothouse, and twelve in the second. During the period of fructification the temperature must be kept at 25 to 30°C. In summer the houses are ventilated to prevent excessive temperatures. Plantation and harvesting may be done at any time of the year. The most common varieties are "Jamaica" and "Cayenne".

The fruit to be exported is carefully packed in pine-wood cases with double-bottoms through which the peduncle is passed. Each case contains from 1 to 6 or 8 fruits.

During 1903-1916 the annual export from San Miguel was from 1 to 1 ½ million of fruits (in round figures) with a value of from 300 000 to 450 000 *milreis* (£ 66 500 to £ 100 000 *at par*). Before the war the principal importing countries, in decreasing order of importance, were:— United Kingdom, Germany, United States, France, Italy.

996 — Overhead Irrigation of Strawberries in Illinois, U. S. A. (1). — See No. 1032 of this Review.

## FORESTRY

997 — The Douglas Fir: Its Importation and Cultivation in Central Europe (2). — BERKHOUT, A. H., in *Mededeelingen van de Landbouwhoogeschool en van de daaraan verbonden Instituten*, Vol. XIV, Pt. 1, 2 and 3, pp. 47-56 + 5 Tables. Wageningen (Holland), 1918.

The American tree commonly known as the Douglas fir was discovered in North America in 1792 by the explorer ARCHIBALD MENZIES and imported into Europe by DAVID DOUGLAS in 1827. The Douglas fir has many names in America — red fir, black fir, hemlock, swan pine, etc. The confusion of botanical names is no less great and is due to the fact that botanists disagree as to the genus to which it belongs; they call it *Abies Douglasii* Lindley, *Pinus Douglasii* Sab., *Pinus taxifolia* Lamb; *Picea Douglasii* Link, *Tsuga* or *Pseudotsuga Douglasii* Carr. There are many varieties of Douglas fir — blue, green, blueish-green (*glauca*), etc.; the last of these has smaller cones and is of slower growth. Douglas fir is one of the most widespread trees in America and is found particularly in the Rocky Mountains, Sierra Nevada, Colorado, and British Colombia. Its geographical distribution is between 43 and 52° north latitude. A well-aerated, very light soil containing a certain proportion of sand and stones, suits it best. It can stand a damp atmosphere better than excessive drought and should be sheltered from continuous winds. In the State of Washington it does very well up to 1150 feet, and in Oregon up to 1800 feet; above this altitude its growth is more restricted. According to MAYR Douglas fir is very resistant to frost in its native country, indeed, it grows in districts where the temperature is sometimes below -25°C. If its importation into Europe has not always given the expected results this is due to the fact that care has not always been taken to use seed from a district in which the environmental conditions are similar to those of the district in which plantations are to be made. It has also been shown that the poor sandy soil, as well as the marsh soil or excessively clayey soil of central Europe, do not suit it. The young plants may also be attacked by a fungus — *Botrytis Douglasii* — and by a canker — *Pestalozzia funera* Desm.

The rapid growth and excellent quality wood of the Douglas fir make it one of the most profitable trees for silviculturists. Data collected by HANZLICK on several plantations show this tree to have attained the following average weights and diameters (in the middle): — in 20 years, 29.83 feet and 0.35 feet; in 40 years, 76.32 feet and 0.69 feet; in 60 years, 101.25 and 1.01 feet; in 100 years, 125.55 feet and 1.34 feet. This fir may reach a height of 330 feet and a diameter of 16.40 feet. On the damp west coast of North America it generally attains in 80 years a height of 130 feet and a diameter of 2.62 feet. Of two neighbouring plantations at the Experiment Station of Wageningen one of these plantations of 18 years had an average height of 38.15 feet and an average diameter of 0.45 feet. The

(1) See R., March and April, 1912, Nos. 486 and 627; R., December, No. 1090; R., Jan. and Dec., 1915, Nos. 95 and 1330; R., May and August, 1917, Nos. 408 and 708. (Ed.)

(2) See also R., Jan. and Feb., 1915, Nos. 61 and 194. (Ed.)

data show that this tree had a diameter of 0.49 feet at Wageningen *five years earlier than in its native country*. Growth is not less rapid in other parts of Europe. In Germany (Oldenburg), a 37-year old plantation had an average height of 59.04 to 65.60 feet and an average diameter of 1.95 feet. Similar figures were obtained in England.

The wood of Douglas fir is solid and very resinous and used for many purposes, such as building wood, props and supports for mines and ship-yards. As timber and wood for commercial purposes it polishes very well and is used for cabinet work, and for making parquet and wainscoting. In Germany, the wood of a 25-year old tree had a specific weight of 0.536 and a resistance to pressure of 443 to 531 kg. per sq. cm.

The author foresees more numerous plantations of this tree in all central Europe, especially in places sheltered from strong winds and in clearings. The necessity of the choice of seed suited to the district, *i. e.*, from a country where the climatic conditions are as similar as possible, is emphasised. In Holland such seed-control is assured by the "Nederlandsche Heide-Maatschappij" (Dutch Association for the Development of Land).

998 - The Utilisation of the Dead Leaves of Forests. — See No. 1042 of this Review.

## LIVE STOCK AND BREEDING.

999 - Purifying Water for Stock. — *Queensland Agricultural Journal*, Vol. VIII, Pt. 4, p. 209. Brisbane, October, 1917.

HYGIENE

Water containing mud in suspension is easily clarified by dropping hot wood ashes into it, or by the application of lime or alum. These two substances make the water hard. Chloride of iron may be also used; it is quite harmless, and a valuable reconstituent and tonic for all animals. One lb. of chloride of iron will clarify 1 000 to 2 500 galls. of water and much reduce the bacterial content.

A simple method of purifying water without boiling has been devised by Dr. NAISMITH and Dr. GRAHAM. The method consists in adding a level teaspoonful of chloride of lime (containing  $\frac{1}{3}$  available chlorine) to a cupful of water. Dissolve, dilute with 3 more cupfuls of water, allow to stand for a few seconds; this stock solution, kept in a tightly stoppered bottle, may be used for 5 days. Add a teaspoonful to 2 galls. of water to be purified; stir well to bring the weak chlorine solution in contact with all the bacteria, and allow to stand for 10 minutes. This will destroy all typhoid and colon bacilli, or other dysentery producing bacilli in the water. The water will be without taste or odour and the trace of free chlorine added rapidly disappears.

1000 - Cut-throat Grass (*Panicum Combsii*) and Salt Sickness; Investigations in the United States. — PIPER, C. V. (Office of Forage Crop Investigations, Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of the American Society of Agronomy*, Vol. X, No. 4, pp. 162-164. [Washington, March 20, 1918.

Cut-throat grass (*Panicum Combsii*) has so far been described for Florida, Georgia, and the south of Alabama, Mississippi and Louisiana, as

a rare species found especially on the edges of ponds. The author found it in great abundance in Polk County, central Florida, where it forms most pure growths of tufty bushes with tough, wiry leaves, almost erect, and from 6 to 18 inches long. Breeders in the district use it as a winter forage for fattening adult steers and non-pregnant cows, but believe it causes abortion in pregnant cows and a disease known as "salt sickness" in young animals. This disease which has frequently been studied in Florida is characterised by chronic anaemia, loss of flesh, loss of appetite, thin, pale blood, white mucous membranes, etc. STOCKBRIDGE, FRENCH and ENNIS (*Florida Agricultural Experiment Station Report*, 1900-1901, pp. 43-58, 1902) believe the cause of salt sickness to lie in the food and recommend as remedies alimentary correctives and tonics, as well as a change of pasture as a preventative and curative measure. Lime water, gentian, or iron salts ( $\frac{1}{2}$  oz. air-slacked lime or  $\frac{1}{8}$  oz. of iron sulphate in 3 gallons of water, the first *ad lib.*, the other once a day) have always proved useful. On the other hand C. F. DAWSON (*Florida Agricultural Experiment Station Bulletin* 64, 1902) believes salt sickness to be chronic Texas Fever (piroplasmosis) and that the food eaten is but a secondary cause.

1001 - **Gossypol, a Toxic Substance in Cottonseed** (1). — WITHERS, W. A. and CARRUTH, F. E., in the *Journal of Agricultural Research*, Vol. XII, No. 2, pp. 83-101 + 10 Tables + 1 Plate + Bibliography of 19 Publications. Washington, January 14, 1918.

Raw cottonseed kernels contain about 0.6 % of gossypol and are highly toxic to rats. Ether extraction renders the material non-toxic and gives a highly toxic extract containing about 2 % of gossypol. Gossypol fed in milk diets in amounts equivalent to those contained in the raw cottonseed diets proved as toxic as raw cottonseed. Gossypol may be quantitatively removed from the ether extract by precipitation as its insoluble anilin compound ( $C_{30}H_{28}O_9 \cdot 2C_6H_5NH_2$ ). The extract is thus rendered non-toxic to rats. Gossypol prepared from this compound possesses its original toxic properties.

Cottonseed meal is much less toxic than raw cottonseed, owing mainly to the oxidation of gossypol during cooking.

Cottonseed meal, ether-extracted cottonseed, and gossypol were fed to small pigs in pens under comparable conditions. Cottonseed meal was found to be definitely injurious, while the ether-extracted raw seed did not appear to cause cottonseed-meal poisoning. Gossypol was toxic to pigs.

If the presence of an injurious substance in the meal is disregarded, a diet of cottonseed meal and maize meal has nutritive limitations which may, under restricted conditions of living, lead to failure of pigs to thrive. Such failure is a phenomenon distinct from cottonseed-meal poisoning. Outdoor exercise, access to forage and soil, and improved diets tend to postpone or avert cottonseed-meal poisoning of swine. The deficiency hypothesis that cottonseed-meal poisoning of swine is similar to beriberi is untenable.

(1) See also *R.*, Jan. 1918, No. 64 and March, 1918, No. 306. (Ed.)



1002 — **Observations on the Etiology of Epizootic Lymphangitis** (1). — VELU, H., in the *Bulletin de la Société de Pathologie exotique*, Vol. XI, No. 5, pp. 351-357. Paris, May 8, 1918.

The author gives an account of his observations on the etiology of epizootic lymphangitis, resulting from work carried out in the research laboratory of the "Service de l'Élevage" at Casablanca.

1) *Contagion*. — Epizootic lymphangitis is transmitted by simple direct or indirect contact; immediate contagion is the rule. Inoculation takes place through the harness or grooming, infected hands of veterinary surgeons or farriers, soiled grooming tools, etc.

Experiments on the part played by flies gave negative results, without proving, however, that they play no part.

2) *Penetration*. — Transmission commonly occurs by means of some skin (harness wound, kick, fracture, injury, war wound, etc.) or mucous (auto-inoculation) erosion. Any break may serve as an entry to the RIVOLTA cryptococcus, which appears to be a saprophyte common in warm, damp climates. In Morocco, where the cryptogamic flora is extremely rich, epizootic lymphangitis is an ordinary complication of all severe wounds or fistulous sores that do not receive regular antiseptic dressings.

With the present state of our knowledge the disease cannot be transmitted with certainty. The positive results obtained by DELAMOTTE and other workers should be accepted with caution, as the exceptionally long period of incubation allowed by them does not exclude the possible intervention of other factors of infection. Other authors, however, have obtained negative results.

As a general rule, the primary lesions in epizootic lymphangitis are dermal or intradermal. The author attempted to ascertain whether inoculation in the dermis would lead to the appearance of the disease. In the more fortunate cases the result was the formation of a single abscess which proceeded towards recovery without the formation of secondary boils. Intravenous injection of large doses of pus were never followed by even the slightest reaction. The insertion of virulent matter into the bone marrow did not give good results. It was even found impossible to cause the formation of specific lesions by auto-inoculation.

BRIDÉ, NÈGRE and TROUETTE have found that hypodermic injections of yeasts cause the formation of abscesses; the organism shows a greater intolerance to each new injection; instead of acquiring immunity against the yeasts it appears to become accustomed to expell them. The author has observed similar phenomena in the case of the cryptococcus during attempts at pyovaccination.

1003 — **Preliminary Report on the Virulence of Certain Body Organs in Rinderpest**. — BOWNTON, W. H., in *The Philippine Agricultural Review*, Vol. X, No. 4, pp. 410-433. Manila, 1917.

The following results were obtained while endeavouring to devise a

(1) See R., June, 1917, No. 561; R. August, 1917, No. 734; R. Feb., 1918, Nos. 177 and 178; R., March, 1918, Nos. 310 and 311. (Ed.)

method of securing the aggressins of rinderpest. Since the virus of rinderpest cannot at present be satisfactorily cultivated under artificial conditions, it was decided to try to extract the virus from the tissues of animals suffering from this disease. From the symptoms, lesions, and microscopical findings, it is quite evident that the virus attacks primarily the involuntary muscles and endothelial lining of the capillary vascular system and the parenchymatous tissue. From the results obtained by the intravenous injection of various drugs and disinfectants it is quite evident that the virus of rinderpest does not have its fountain head of development in the blood stream. The real place where the virus multiplies appears to be inside the tissue cells where the disinfectants can not penetrate, the virus in the blood stream being merely a surplus which is thrown off from these tissue cells. In following this line of reasoning the writer decided to consider certain tissues where lesions were more or less pronounced, as cultures and extracts were made from them. The tissues used by him were liver, spleen, lymph glands, heart, intestines, thymus, skeletal muscle, larynx, pharynx, and the back of the tongue from animals which were either bled to death for virulent blood or from animals which had died after a regular course of the disease.

The tissues were taken from the animal as soon after death as possible. The amount of tissue desired was weighed, ground in a sterilised meat grinder and placed in a sterilised flask where twice as much phenol solution was added. This material was thoroughly agitated two or three times a day and kept in the refrigerator at 15-16°C., or it was agitated continuously for 48 hours at room temperature, then placed in the refrigerator for 24 hours, and then filtered through gauze and the filtrate replaced in the refrigerator until used for injection to carabaos.

The results may be summarised as follows :—

Water extracts of the liver, spleen, and lymph glands 3 days old and a 0.5 % phenol extract of liver, spleen, lymph glands, heart muscle, caecum and colon 5 days old are highly infectious to susceptible animals. On the other hand, the skeletal muscle, the larynx, pharynx and base of tongue and the pancreas are not suitable tissues for making extracts in the case of rinderpest. A 0.5 % phenol extract of liver, spleen and lymph glands holds the virus of rinderpest in a virulent form for periods of time varying from 8 to 55 days. A 1 % phenol extract of liver, spleen, caecum and lymph glands 17 days old are highly infectious and a 1 % phenol extract of liver and spleen 21 days old are virulent to susceptible animals. When glycerin is added to a 2 % phenol extract which had been agitated for 48 hours the virus of rinderpest is readily destroyed. In a 2 % phenol extract of lymph glands 8 days old the virus of rinderpest is destroyed. It is advisable to use a 0.75 % phenol extract not over 15 days old. The tissues best adapted for this work are the liver, spleen, lymph glands, heart, fourth stomach, caecum and colon.

From the results obtained in working with rinderpest it is very plausible that similar or even better results may be obtained with the virus of hog cholera along these lines.

1004 - Observations on the Control of *Rhipicephalus annulatus australis*, in Queensland, Australia. — THOMSON, F., KEOGH, G., and TUCKER, G., in the *Queensland Agricultural Journal*, Vol. VIII, Pt. 6, pp. 302-307. Brisbane, December, 1917.

The Queensland cattle tick (*Rhipicephalus annulatus australis*) lives as a parasite on cattle only. The females, gorged with blood, drop to the ground, where three days later they begin to lay; they continue for 10 to 21 days, each one laying from 1 500 to 3 000 eggs. These hatch during a period of 21 to 42 days. The larvae climb on to leaves, fence posts, and similar objects, where they can live without food for several months. If they find no host they eventually die; if they attach themselves to an animal they pierce the skin and feed on the blood. After 7 days of parasitic life they pupate, and after another 7 days the adults emerge. The adults live on the host for another 7 days; during the last 24 hours the females gorge themselves with blood, then drop to the earth, and the cycle re-commences.

The Department of Agriculture of Queensland recommends the following dip against ticks: — commercial arsenic, 1 700 gm.; caustic soda, 800 gm.; tallow, 800 gm.; vegetable tar, 1 litre; water, 800 litres. The animal must be completely covered by the solution, and should even be made to swim in it. This method has been employed in Queensland for about 20 years with excellent results. There is no doubt that an animal which has been twice dipped at intervals of 8 days is perfectly free from ticks and may be sent into an immune district without danger of its carrying the parasite there.

Of recent years breeders have tended to reduce the concentration of the dip, by reducing the amount of arsenic to 1 400 and even 1 200 gm. per 800 litres of water, and to replace dipping by spraying. A series of experiments made at the Stock Experiment Station at Townsville showed conclusively that: — 1) the official formula must not be diluted; 2) spraying, even if repeated each week for several months is not as efficient as dipping at intervals of one or two weeks; consequently spraying is inefficient as a control.

1005 - Thymic Acid and Thymol in the Treatment and Prevention of Intestinal Coccidiosis in Cattle. — TREMONA, P. (R. Scuola Superiore di Medicina Veterinaria di Torino), in *Il Nuovo Ercolano*, Year XXIII, No. 10, pp. 113-115. Turin, May 31, 1918.

According to observations of the author, Dr. SANLORENZO and others, intestinal coccidiosis or red scur frequently affects cattle in the marshy regions to the north-west of the province of Venice. In confirmation of the results obtained by Dr. SANLORENZO, the author obtained recovery in 4 to 6 days by administering thymic acid at the rate of 15 gm. for adults and 10 gm. for calves. In order to prevent the disease, he dosed the healthy animals for 3 days with 5 gm. of thymol per head per day.

1006 - Life History of *Ascaris lumbricoides* and Related Forms. — RANSOM, B. H. and FOSTER, W. D. (Zoological Division, Bureau of Animal Industry, U.S. Dept. of Agric.), in the *Journal of Agricultural Research*, Vol. XI, No. 8, pp. 395-398. Washington, D. C., November 19, 1917.

The life history of *Ascaris lumbricoides*, the common intestinal round-

worm of man, and of *A. suum* or *A. suilla*, of very common occurrence in the intestine of pigs, has been recently studied by F. H. STEWART, of the Indian Medical Service. In spite of their different names, these worms are the same parasite, or forms so closely related that they are morphologically indistinguishable. As a result of his investigations STEWART was led to a conclusion contrary to the usually accepted opinion that the infection of man or pig with *Ascaris* results from the ingestion of the eggs of the parasite. He concluded that it is necessary in the life cycle for the eggs to be swallowed by rats or mice and that in these animals the embryos hatching from the eggs undergo certain migrations and developmental changes, after which they may be transferred in the faeces or saliva of the rats or mice to food or other materials likely to be ingested by human beings or pigs, and thus ultimately reach their final hosts. The authors have reviewed and repeated STEWART's experiments, and from the various contributions of other investigators toward the solution of the problem of the life history of *A. lumbricoides* and related parasites, and their own experiences, arrive at the following conclusions:—

The development of *A. lumbricoides* and closely related forms is direct, and no intermediate host is required. The eggs, when swallowed, hatch out in the alimentary tract; the embryos, however, do not at once settle down in the intestine, but migrate to various other organs, including the liver, spleen, and lungs. Within a week, in the case of the pig *Ascaris*, the migrating larvae may be found in the lungs and have meanwhile undergone considerable development and growth. From the lungs the larvae migrate up the trachea into the oesophagus by way of the pharynx, and this migration up the trachea may already become established in pigs, as well as in artificially infected rats and mice, as early as a week after infection. Upon reaching the alimentary tract a second time after their passage through the lungs, the larvae, if in a suitable host, presumably settle down in the intestine and complete their development to maturity; if in an unsuitable host, such as rats and mice, they soon pass out of the body in the faeces.

Heavy invasions of the lungs by the larvae of *Ascaris* produce a serious pneumonia which is frequently fatal in rats and mice and apparently caused the death of a young pig one week after it had been fed with numerous *Ascaris* eggs. It is not improbable that ascarids are frequently responsible for lung troubles in children, pigs, and other young animals. The fact that the larvae invade the lungs as well as other organs beyond the alimentary tract and can cause a serious or even fatal pneumonia indicates that these parasites are endowed with greater capacity for harm than has heretofore been supposed.

Age is a highly important factor in determining susceptibility to infection with *Ascaris*, and susceptibility to infection greatly decreases as the animal becomes older. This, of course, is in harmony with the well-known fact that it is particularly children and young pigs among which infestation with *Ascaris* is common, and that *Ascaris* is relatively of rare occurrence in adult human beings and in old hogs.

1007 - "Askaron", a Toxic Constituent of Intestinal Worms, especially of Ascarids, and its Biological Action. — SHIMAMURA TORAI and FUJII HAJIME, in the *Journal of the College of Agriculture, Imperial University of Tokyo*, Vol. II, No. 4, pp. 189-258 + 4 Figs. + Bibliography of 12 Publications. Tokyo, 1917.

The authors have isolated from the mesenteric liquid of dried and powdered ascarids (*Ascaris lumbricoides* of the pig and *A. megalocephala* of man) an extremely toxic propeptone, for which they propose the name of "askaron". This propeptone produces all the symptoms of poisoning observed in ascariadasis and following on injections of the mesenteric liquid or aqueous extract of ascarids. It is also present in other intestinal worms. The authors have found it present (with the same toxic properties) in *Filaria immitis*, the larvae of *Gastrophilus*, *Sclerostomum vulgare*, *Oxyuris curvula*, *Trichocephalus depressiusculus*.

The ether and alcoholic extracts of dried, powdered ascarids are non-poisonous even in strong doses, but they always have a haemolytic action not possessed by "askaron".

The most sensitive among the experimental animals were found to be horses, then guinea-pigs, dogs and rabbits; rats and mice were refractory. The chief symptoms of "askaron" poisoning are troubled breathing, dilatation of the peripheral blood vessels, increased secretions and excretions, nervous disturbances, depression of the temperature and arterial pressure; on autopsy, are observed:—dilatation of the lungs (in guinea-pigs); hyperaemia and haemorrhagic exudation in the gastro-intestinal canal, in the endocardium and internal organs (particularly the lungs); partial coagulation of the blood. The fatal dose of crude "askaron" per kg. of live weight, given intravenously, is 0.004 mgm. for the horse, 0.8 mgm. for the guinea-pig, 2 mgm. for the dog, and 5 mgm. for the rabbit.

In the horse, the instillation of even very dilute solutions (up to 1 in 10 000) of crude "askaron" always produces a copious lachrymal secretion, which is supposed to be due to the volatile constituents of the "askaron". On repeatedly giving instillations, the reaction becomes weaker and weaker, but never wholly disappears.

After a first poisoning by "askaron", great resistance is quickly developed; the "askaron" obtained from different species is reciprocally immunising and to an equal degree.

"Askaron" is primitively toxic; the normal serum of the horses contains no antibody against "askaron". The horse can be actively immunised against a dose of askaron 400 times the mortal one; this great immunity is probably due to cellular resistance.

"Askaron" should be considered as a metabolic product of the worms.

1008 - I. Morphology of Normal Pigs' Blood. II. Effects of Muscular Exercise and the Heat of the Sun on the Blood and Body Temperature of Normal Pigs. — PALMER, C. C. (Veterinary-Research Laboratories, Minnesota Agricultural Experiment Station), in: I. *Journal of Agricultural Research*, Vol. IX, No. 5, pp. 131-140. Washington, DC., April 30, 1917; II. *Ibid.*, Vol. IX, No. 6, pp. 167-189 + Bibliography of 9 Publications. May 7, 1917.

I. — The work reported in this paper was undertaken with the view

of establishing normal data under conditions which exist in Minnesota as a basis for future studies and so corroborate the work of other investigators.

After an historical review of the subject, the author describes his own experiments and summarises the results obtained as follows:—

The number of erythrocytes in the blood of the pig varies under different conditions. It is lower in young animals than in old. It also varies according to the condition of the animal. A well-nourished pig in good condition will show a higher count than a pig in poor condition and of the same age. It was about equal in the blood of male and female animals.

The leucocyte count was lower in young animals, but individuals of the same class may show considerable variation. It seems to be higher in male than in female animals.

The percentage of haemoglobin was higher in older animals; it was higher in male than female animals.

The specific gravity of the blood was higher in older animals.

The clotting time was less in younger animals.

Five classes of leucocytes can be recognised in the blood of the pig:—Lymphocytes, large mononuclears, polymorphonuclears, eosinophiles, and mast cells. Results of the differential counts by various workers are fairly uniform. The percentage of lymphocytes and large mononuclears is higher in young animals. Older animals show a higher percentage of polymorphonuclears, eosinophiles, and mast cells than young animals. Differential counts in male and female animals are about the same.

II. — This work was carried out, in part, along with the preceding one. The author's summary is given below.

1) Blood examinations in normal resting pigs, covering a period of 24 hours, may be quite uniform; but in some animals there is marked variation throughout the period.

2) Observations made upon a number of animals leads to the conclusion that muscular exercise does not cause an increase of red corpuscles in the peripheral circulation of the pig.

3) Results based on only one or a few experiments may lead to wrong conclusions, owing to the variability in the blood of pigs.

4) Evidence given by work with the pig tends to confirm the theory of perspiration being responsible for the increase in the number of red corpuscles following muscular exercise in man.

5) Muscular exercise in the pig is usually followed by a leucocytosis.

6) This leucocytosis is probably the result of muscular exercise forcing leucocytes into the general circulation from the tissues.

7) Muscular exercise leads to marked changes in the differential counts. The mononuclear elements are decreased, and the polymorphonuclear elements are increased. The height of the curve is reached several hours after exercise, and the normal proportions do not return for many hours.

8) Exposure to the sun causes similar changes in the differential curve.

9) These changes under both conditions are the result of increased rate of aging of the leucocytes, the cells becoming older faster than young cells are being produced.

10) Muscular exercise and heat of the sun lead to a marked increase in body temperature.

11) Body temperature changes are more pronounced in fat pigs than lean ones, but even in pigs weighing 75 to 100 pounds marked changes are likely to occur.

12) Increased atmospheric temperature and increased percentage of humidity lead to increased body temperature.

13) Blood examinations of pigs which are to be used for clinical records should be taken from animals which have been confined in a small cool pen for at least 24 hours, and better, 48 hours. The animals must be kept absolutely quiet and not worried. Feeding and watering should be regular. The daily blood examinations should be made at the same time on each day.

14) Temperature records which are to be used for clinical records should be taken from pigs kept in a cool, shady pen. The animals should not be exercised or worried when the temperatures are taken. If the animals are chased around the pen when endeavouring to obtain the temperature, the last temperatures taken may show a marked rise. For tuberculin work where the temperatures are used it would be best to keep them confined in a crate throughout the test.

15) The condition of the animal (amount of fat), the temperature of the atmosphere, and the percentage of humidity are factors which should be considered in determining the normal temperature of the pig.

**1009 - Investigations into the Action of the Thyroid Gland, in the United States. —**

I. ALLEN, B.M., The Results of Thyroid Removal in the Larvae of *Rana pipiens*, in *The Journal of Experimental Zoology*, Vol. XXIV, No. 3, pp. 499-520 + 4 Tables + 8 Figs. + 1 Plate. — II. SWINGLE, W. W., The Acceleration of Metamorphosis in Frog Larvae by Thyroid Feeding and the Effects upon the Alimentary Tract and Sex Glands, *Ibid.*, pp. 521-543 + 1 Table + 14 Figs. + Bibliography of 11 Publications. Philadelphia, January, 1918.

I. — Although numerous investigations have been made into the effects of removing the thyroid gland from young and adult animals, there are no data on the results of removing this gland from animals at a very early stage of their development. Such an operation is exceedingly difficult in the embryonic stages of reptiles and birds, and almost impossible in that of mammals. The author, therefore, used amphibians for this purpose, taking as subjects tadpoles of *Rana pipiens*, of which the metamorphosis offers a very wide field of observation. It was found that the complete removal of the thyroid gland does not affect the course of early development till the hind limbs have begun to grow; further differentiation then ceases and metamorphosis does not occur. The general soma development, that of the limbs, alimentary tract and brain (the anterior portion of the head is of abnormal form, lengthened and broadened) were specially studied. No other organ seemed to show any further differentia-

tion, except the gonads, which were unaffected by the removal of the thyroid gland. This coincides with WEISSMANN's hypothesis of the independence of the germ plasma from the soma. The administration of thyroid extract to these larvae caused a resumption of growth even four months after it has ceased, thus corroborating the results of the following investigations.

II. — Other workers have observed that thyroid feeding greatly hastens the differentiation and metamorphosis of tadpoles. In this manner GUDERNATSCH obtained from frog larvae in a very short time perfect frogs no larger than flies. The author continued these experiments with a special view to the influence on the reproduction organs. Frog larvae were fed a powdered thyroid extract mixed with 30 % its weight of flour. Immediately after the administration of this food the subjects ceased to grow, eight days later limb buds were observed with a hand lens. Pigmentation was rather more marked than in the control animals, and in a very short time the subjects had all the characteristics of adult frogs, with the exception of the gonads and germ cells, the development of which was similar in the experimental and the control animals.

*Results.* — 1) There is no immediate physiological connection between the thyroid gland and the reproduction organs of amphibians.

2) With this exception the administration of thyroid extract to frog larvae has a marked influence on the bodily changes of the animals, all the organs and systems passing rapidly from the larval condition to that of the adult.

#### FEEDS AND FEEDING

##### 1010 — Effect of Time of Digestion on the Hydrolysis of Casein in the Presence of Starch.

— MCHARGUE, J. S. (Laboratory of Chemical Research, Kentucky Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. XII, No. 1, pp. 1-7. Washington, D. C., January 7, 1918.

The Van Slyke method for protein analysis (*Journal of Biological Chemistry*, Vol. X, No. 1, pp. 15-55, 1911) was worked out upon mixtures of relatively pure amino-acids and was not intended to be applied directly to crude sources of protein contained in cereals and feeding stuffs. Notwithstanding this fact, GRINDLEY, SLATER et al., of the Illinois Experiment Station, published in 1915 the results of the determination of the amino-acids contained in cottonseed meal, tankage and alfalfa hay, applying the Van Slyke method directly to the proteins contained in these different feeds. A little later NOLLAU, of the Kentucky Experiment Station, published his results, obtained by the same method, on about 25 different sources of crude protein contained in various seeds and feeding stuffs. In December 1915, GRINDLEY, SLATER et al., published a second paper on the amino-acid content of various feeds, including wheat, oats, barley and soy bean, a number of which had been analysed by NOLLAU. They obtained results which did not agree well with those of NOLLAU. HARTH and BENTLEY, of the Wisconsin Experiment Station, commenting on this lack of agreement have stated that whether accurate determinations of any or all the amino-acids can be secured when the hydrolysing proteins are in contact with hydrolysing carbohydrates must first be ascertained before these data can be accepted as final. HART and SURE have



published results obtained upon the hydrolysis of casein, alone and in presence of a number of different carbohydrates, on a 48-hour digestion and concluded that their work on casein and GORTNER's work on fibrin hydrolysed in the presence of cellulose *definitely* show the inapplicability of direct hydrolysis for the estimation of amino-acids in feeding stuffs by the Van Slyke method. But it occurred to the author that a duplication of the experiment of HART and SURE, carried on at varying lengths of time of digestion, would afford more conclusive evidence on this subject, as it is by no means to be taken for granted that results obtained on a 48-hour digestion will be the same as those carried on for a shorter length of time. Accordingly he planned the experiments described in the paper under review, and which led to the following conclusions:—

The Van Slyke method for protein analysis, when applied to mixtures of casein and starch in the proportion of 1 to 5, and hydrolysed from 12 to 15 hours with 20 per cent hydrochloric acid gives results for the amino-acid groups that are comparable with those obtained by Van Slyke upon casein alone.

A digestion period of more than 15 hours with 20 per cent hydrochloric acid on a casein-starch mixture brings about a redistribution of the nitrogen contained in the histidin and cystin groups.

The insoluble residue obtained from a casein-starch digestion after being thoroughly washed contains nitrogen, which is not seriously affected when distilled with calcium-hydrate suspension, very small amounts being split off as ammonia or remaining in the filtrate. This indicates that the nitrogen is in an inert form and its estimation should not be included in the humin determination.

1011 — **The Influence of the Food on the Vitamine Content of the Milk.** — See No. 952 of this *Review*.

1012 — **Aquatic Plants Which May Be Used as a Food for Cattle: Investigations in Holland.** — *Nederlandsch Weekblad voor Zuivelbereiding en Veeveest*, Year XXIV, No. 10, p. 2. Doetinchem, June, 1918.

In view of the present scarcity of cattle food various sources of such food have been studied, among others three aquatic plants: 1) *Lemna trisulca* (duckweed); 2) *Elodea canadensis* (water-weed, ditch-moss, water-thyme); 3) *Azolla* sp. The experiments made at the cattle Food Control Station of Wagenningen showed that those plants may well be utilised as a cattle food. They may be fed either fresh or washed to cattle and pigs. As at the season when these plants may be gathered there is usually sufficient green fodder, it is of special use to preserve them. As artificial desiccation would be too expensive for this purpose, it is more practical to ensilage them.

Analysis of fresh duckweed, water-weed and *Azolla* gave the following figures for each plant respectively.: — Albuminoids, 1.8, 1.4, 2.3 %; fats, 0.2, 0.1, 0.3 %; starch, 2, 1.9, 5.1 %; crude fibre, 0.6, 11.0, 2.0 %; moisture, 94.3, 94.6, 88.0 %; ash, 1.1, 0.1, 2.4 %.

After desiccation these plants retain good albuminoid and starch

contents. This is shown by the following percentages (dry matter basis for duckweed, *Azolla* and water-weed respectively; — Albuminoids, 31.5, 2.6, 18 %; fats, 3.5, 1.8, 2.5 %; starch: 35, 35.2, 42.5 %.

1013 — **Digestible Hay Cake and Hay Paste.** — GAIN, E., in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 539-543. Paris, May 15, 1918.

In order to utilise hay to better advantage the author states the principles by which he was governed in making digestible hay cake and hay paste, with the intention of giving later the physiological characteristics which he is still studying and which may support his claims for its practical value. He tested the use of cake prepared by his method on horses, which ate it readily. The *method of raising the yield of hay* by making *cake* and *paste* includes physical and chemical-biological procedures which permit the modification of the physical condition, digestibility, nutritive ratio and adipo-protein ratio. The aim is to increase the quantity of useful nutritive matter.

A. — PHYSICAL PROCESSES. — Crushing and partial cooking.

It is sufficient to crush, sift and pass the powder through an electro-magnet to remove the metallic particles. By mixing the product with water, cake, lozenges, etc. may be made. Crushed oats may be incorporated. Better results may be obtained by partially cooking the cake by drying at 60°C., followed, if desired, by rapid superficial heating. The author also tested short treatment in the autoclave.

B. CHEMICAL AND BIOLOGICAL PROCESSES. — Special chemical, diastatic and fermentation treatments, to affect the chemical composition to a more marked degree than by the physical processes.

The nutritive ratio (or food quotient of hays) and the adipo-protein ratio may easily be altered; by changing them the coefficient of digestibility is modified. To the crushed hay may be added other products: — concentrated foods such as oil cakes (1 to 5 % only), small fodder seeds or flours, young leaves of forest trees, reeds, sedges, etc., and even foods with a specific action or simple chemical addition (e. g. glycono-phosphates).

C. — FERMENTATION OF THE HAY POWDER BY COMPRESSION. — The ferment actions capable of influencing the real value of hay vary in nature. They may be concerned with the different immediate principles, especially the liberation of useful elements, by attacking more or less severely the ligneous covering in which they are often enclosed. *Hay from stomachs* often give a useful flora capable of acting on the powder to be made into cake. The author made several tests with the classical diastases, *hay from ox's stomach* and *hay from sheep's stomach*, commercial yeast, a hay infusion, and, finally with partial sterilisation and the dissociative action of steam under pressure in the autoclave.

One of the chief elements of the value of hay lies in the seeds of the plants composing it. The harvest is, however, hastened so that the hay may be tender and ripe seeds are rarely found in hay. With digestible hay cake it would be advantageous to harvest later.

A small part of the hay might be fed as paste, the preparation of which

only requires crushing, sifting and kneading with 3 or 4 times more water than powder, by weight. The product is very similar in appearance to hay from sheep's stomach. It may be dried in the air, compressed, or fed fresh mixed with other food. Crushed seed, nettle leaves, leaves of young trees, sedges, reeds, etc., may be added.

1014—**The Zebra and its Hybrids as Domestic Animals.**—FAWCETT, W., in *La Hacienda*, Vol. VIII, No. 8, pp. 242-245 + 9 Figs. Buffalo, N. Y., May, 1918.

HORSES

For more than a century attempts have been made in various countries to utilise the zebra and its hybrids for agricultural purposes. The zebra can be bred as a domestic animal. The first hybrids were obtained by crossing a female zebra and an ass, then by crossing a female zebra with a horse, and also by crossing a mare with a male zebra. A zebra  $\times$  ass cross was obtained by LORD CLIVE towards the end of the 18th century; later on similar crosses were obtained in France and Italy. Further crosses were also obtained, especially in Great Britain, Australia and France. Crosses were obtained in Brazil in 1899 and 1900 and also in Scotland (by Prof. COSSAR EWART) between small pony mares and male zebras. HERR HAGENBECK has obtained crosses between female zebras and pony stallions.

The different species of zebra (1) have all been used for crossing, and some seem better suited than others. Burchell's zebra (which was used by Prof. EWART for crossing) has been used very often; the mountain zebra, common in South Africa, has been used. For other crosses, especially those carried out by the U. S. Government, Grevy's zebra was used. This latter is somewhat larger than the others being 52 and 56 in. high; an adult animal weighs from 770 to 880 lb. It occurs in Abyssinia and Somaliland, but it is gradually becoming rarer and rarer, while it is with difficulty transported from the place of capture to countries across the sea. Although it has never been domesticated, it is docile and would probably be easy to domesticate and rear. The male shows great dislike of mounting large mares, even if he has grown up with them from a foal. On the other hand he readily mounts small mares or she-asses.

The hybrids obtained in the United States are very vigorous and resist the cold of temperate regions as well as does the ass. They show a decided improvement over the parents as regards their form, movements, and way of standing. The average weight at birth is 48 lb.; at 1 year 275 lb., when the average height is 48 in.

The cross she-ass  $\times$  zebra are very obstinate and hard-mouthed, which constitutes an obstacle to their use as working animals. On the contrary the cross mare  $\times$  zebra is more docile and tractable, and can be used like the mule, over which it has the advantage of being much better shaped.

In crosses made in the United States between mares and zebras, the stripes in the coat of the hybrid were indistinct and the characters of the

(1) Three species of zebra are recognised:—*Equus zebra*, the common or mountain zebra *E. burchelli*; *E. grevyi*. The latter is heavier than the others, with closer and darker stripes. (F. E. BEDDARD, *The Cambridge Natural History*, Vol. X, pp. 244-245, London, 1909).

mother predominated. In other crosses made in South America and Europe the characters of the father were predominant and the stripes were still more marked than those of the father.

## CATTLE

1015 - **The Origin and Improvement of Cattle in Colombia.** — GONZALES, T. L., in *Revista agrícola, Órgano del Ministerio de Agricultura y Comercio*, Year IV, No. 1, pp. 12-23 + 2 Figs. Bogotá, January, 1918.

The first imported cattle in Colombia were brought there by the Spanish "conquistadores"; they included 37 animals, male and female, and were imported from Andalusia by RUIZ DE LUGO in 1570. The conditions were very favourable to their development, especially in the large plains of San Martín and Casanare and their numbers increased in an astonishing manner. Later there were imported into Colombia some of the cattle which had been introduced by the French and English into North America in the 16th and 17th centuries and had become acclimatised there. Finally a few selected and improved cattle were imported from the United Kingdom.

Colombia is specially suited to the production of butcher's cattle and the breeding animals sought for are those of beef breeds. The best results on the American Continent have been obtained with the Hereford, Short-horn, Angus and Galloway breeds; of these the author considers the first the most suited to all the environmental conditions of Colombia. At one time zebu were bred in Colombia, but their hybrids with the native cattle were not satisfactory, of bad form and savage nature, and producing only a medium meat.

The decree No. 77, passed in 1917 to encourage the importation of breeding stock for improving Colombian cattle and the crossing of its breeds with foreign selected breeds so as to produce stronger animals, of more rapid development and better form, granted breeders importing animals for the improvement of cattle a third of the total expenses incurred till the animal reached its destination, including the price paid for it. A sum of 50 000 *gold pesos* (£ 9 900 *at par*) has been allocated for the buying of breeding stock to be sold by auction.

## GOATS

1016 - **The Angora Goat in Madagascar.** — CARONGEAU, in the *Revue agricole et vétérinaire de Madagascar et Dépendances*, Year II, No. 17, pp. 110-112. Tananarive, March, 1918.

The author brought to Madagascar three male and three female Angora goats from the Naivasha Experiment Farm (Australia). The animals were sent to the ostrich farm at Tuléar where a small herd has been formed under the direction of the veterinary surgeon, M. GRANDMOUGIN.

At the end of 1915 a small herd of native goats was formed for breeding with the males. Excellent results were obtained. In 1916 the herd included 5 pure-bred males and 11 pure-bred females, as well as 9 cross-bred kids of the first generation.

On December 31, 1917, M. GRANDMOUGIN stated that the angoras had adapted themselves remarkably, to such an extent, indeed, that their vitality may be said to be superior to that of the native goats. It was possible to cure Angora goats suffering from scab, whereas, in Madagascar

goats living under the same conditions, the disease made slaughtering unavoidable, whatever treatment was adopted.

The herd is composed of 80 animals including 30 pure-breds, of which 8 are males, and cross-breds of the first and second generation. The animals pass the whole day on pasture land and receive no supplementary ration.

It has thus been proved that it is possible to breed Angora goats successfully in Madagascar. Numerous breeding centres could be formed throughout the south, as the Angora does well where the Merino can no longer live.

1017 — **Mussels as Food for Pigs: Investigations in Demark.** — *Ugeskrift for Landmand*, No. 23, pp. 313-314. Copenhagen, June, 1918.

PIGS

The following investigations were undertaken at Rosvang (under the direction of Inspector LÆGAARD) with a view to determining the efficiency of mussels as a food for pigs.

In the first experiment all the animals received per head in 10 days 66 lb. of "Mælkeriaffald" (skim and butter milk); those of Group I received in addition 56.1 lb. of barley, those of Group II 41.3 lb. of barley + 22.4 lb. of mussels ("mulsingekod") replacing 14.4 lb. of barley. The increase in live weight for one animal at the end of 10 days was 17.8 lb. for Group I and 8.6 lb. for Group II (fed on mussels).

As this experiment was made at a season when mussels are small a second one was made under much the same conditions but with younger animals. In this case the difference between the two groups was much smaller. In Group I (full grain ration) the increase in live weight per head at the end of 10 days was 13.8 lb.; in Group II (grain ration partially replaced by mussels) it was 12.5 lb.

At the end of the second experiment the quality of the meat was examined, and the flesh and fat of the pigs fed on mussels was found to have a very marked oily smell and flavour, and the melted fat a brown colour. For this reason it is advisable to stop feeding mussels some time before slaughtering. It should also be remembered that raw mussels (with the shells) only supply 10 to 14 % of flesh, so that 2 lb. of shelled mussels will replace 1 lb. of grain in the ration, whereas 16 lb. of mussels with shells are required. After boiling the mussels it was found possible to keep them in buttermilk for four or five days, even during the hottest part of summer, and the same buttermilk could then be used as food.

1018 — **Experimental Modification of Germ Cells and the Effect of Daily Inhalation of Ethyl Alcohol and other Poisons on the Progeny of Poultry.** — PEARL R., I. General Plan of Experiments with Ethyl Alcohol and Certain Related Substances, in *The Journal of Experimental Zoology*, Vol. XXII, No. 1, pp. 125-164 + 3 Figs. + 6 Tables + Bibliography of 43 Publications. — II. The Effect upon the Domestic Fowl of the Daily Inhalation of Ethyl Alcohol and Certain Related Substances, *Ibid.*, Vol. XXII, No. 1, pp. 165-185 + 4 Figs. + 6 Tables. — III. The Effect of Parental Alcoholism, and Certain Other Drug Intoxications, upon the Progeny. *Ibid.*, Vol. XXII, No. 2, pp. 241-310 + 7 Figs + 15 Tables. Philadelphia, January and February, 1917.

POULTRY

The aim of the experiments described was to determine whether it is

possible to modify hereditary factors in any special manner and to observe the effect of such modification from the point of view of inheritance. The problems studied were :—

1) Does the continued administration of ethyl alcohol (or other similar narcotic poisons, such as methyl alcohol and ether) to the domestic fowl induce precise and specific changes in the germinal material, thus causing new, heritable, somatic variations ?

2) In the absence of a specific effect, is there a general effect upon the germinal material leading to degeneracy of the progeny ?

3) What are the effects in general upon the soma of the subject, and do they give any clue to the probable origin and mechanism of the germinal changes ?

I. — The general plan and method, the material and subjects of the experiment are described. The animals used were hybrids from Black Hamburgs (males) and Barred Plymouth Rocks (females). Besides other advantages, the use of hybrids renders possible wider and more precise observations on the eventual variations of the inherited characters as a result of artificial poisoning and the determination of the extent to which these variations deviate from the Mendelian laws. The subjects were divided into 3 groups according to the poison administered—ethyl alcohol, methyl alcohol and ether. These substances were administered by the use of well-closed galvanised iron tanks, in which the animals were placed each day for at least one hour. The floor was made partly of heavy galvanised wire gauze which connected the tank with a cylinder below which was filled with absorbent cotton soaked in the toxic substance. Similar experiments made previously by STOCKARD have shown that the birds absolutely refuse to drink water in which the substance is placed, so that this method is impracticable.

II. — The organic and physiological effects of the inhalation of the toxic substances were studied with the following results :—

1) The *mortality* among the treated birds was much lower than among the control birds from the same parents. After 15 months' treatment the difference was 41 % in favour of the treated birds. This is opposed to the accepted idea that alcoholism shortens life. Too much importance is not attached to this fact and it is believed that as the experiments continue and include more animals this difference will gradually decrease. The photographs show that there is very little difference in the appearance of the treated and untreated birds.

2) The *body weight* of the treated birds began to increase immediately after the beginning of the treatment in autumn. This increase, which probably was not due to the treatment, was greatest in January and February and was followed by a sharp and prolonged fall till May or June, when there was another steady increase till the following February (1916). At this date the treated birds were on the average 9.9 % heavier than the untreated birds.

3) *Egg production* showed no marked difference between the treated birds or control birds ; both groups of birds laid normally in each season.

Throughout the 15 months of the experiment the average production per bird was 184.74 eggs for the controls, and 183.97 for the treated subjects ; the difference — 0.77 — is negligible.

III. — The effects on the progeny of the administration of toxic substances to the parents are given, and the characters which may be expressed quantitatively are examined. Treating one or both of the parents with toxins reduced the *number of fertile eggs*, i. e. those in which a zygote was formed by the union of sperm and ovum. Pre-natal as well as post-natal *mortality* at all ages was lower in this case than in the control birds. The *sex ratio* of the progeny was not affected by the treatment of the parents. Treating the male only did not affect the *weight of the offspring at hatching*, but when both the parents were treated the hatching weight was superior to that of chickens from the control birds. This also holds good for the *adult body weight* of the progeny of both sexes. There was little difference in the *rate of growth* of the male offspring till after 100 days, after which the treatment of the parents resulted in a steady increase in weight. The effect on the female offspring was similar, but occurred only after 200 days.

The treatment did not affect the *proportion of abnormal chickens*, which was similar in both cases. The *Mendelian laws* were not affected, at least as regards dominance, recessiveness and sex linkage. Nothing in the experiments showed the administration of toxic substances to have any injurious effects on those germ cells which formed zygotes. The results obtained support the theory that alcohol and similar substances act as *selective agents on the germ cells* of the treated subjects. It may be assumed that the relative vigour or resisting power of germ cells varies continuously from a low to a high degree. Treatment with alcohol thus has several results :— certain germ cells will be incapacitated from forming zygotes ; these are clearly the least resistant ; others will produce defective zygotes ; these are those which have been unable to resist the poison completely ; finally, those which are not perceptibly affected will produce normal zygotes. This would explain why the progeny of parents which have been treated with toxic substances are, on the whole, superior to those of parents not so treated as regards physical resistance, vigour, development and mortality. In experiments of this kind the ratio between strong and defective zygotes depends on two variable conditions—the amount of toxic substance administered and the average resistance of the germ cells ; this second factor depends on the breed.

These results corroborate those of NICE with mice, as well as the statistical data obtained among the working classes by ELDERTON and PEARSON.

1019 — **The Use of Weevily Wheat for Feeding Poultry.** — *Agricultural Gazette of New South Wales*, Vol. XXIX, Part. 4, p. 292. Sydney, April, 1918.

• Methods for utilising wheat-meal made from weevily wheat for feeding poultry have been tried in the Chemist's Laboratory of the Department of Agriculture, New South Wales. A mixture of 1 of bran to 2 of wheat-meal gave a coarse mixture, but it made a good mash. One part of

bran to 3 of wheat gave a good mash of better appearance, while 1 of bran to 4 of wheat gave a mash of good appearance, that seemed too adhesive for poultry. The bran should be first scalded and then the other ingredients worked into it.

1020 — **The Use of Seaweed in Poultry Feeding** (1). — DECHAMBRE, P., in *L'Agriculture pratique*, Year LXXXII, Vol. XXXI, No. 12, pp. 230-231. Paris, June 13, 1918.

The author describes the experiments made by M. MORTE, at Tré-gastel, Côtes-du-Nord, on the feeding of poultry with seaweed. Ten hens and ten ducklings were fed first on *Laminaria* then on all kinds of algae. The algae were freed from salt by being washed several times in fresh water (this washing is not indispensable). They were then chopped into small pieces from 3 to 5 mm. long; this is easier if they have previously been partially dried. They are then mixed with boiled crushed potatoes and put in a baker's oven for three hours or cooked over a low fire. When the whole is well jellied it is kneaded and distributed to the poultry. The ration given the poultry experimented with varied from 6.6 to 8.8 lb. of algae mixed with 2.2 lb. of potatoes. No grain was fed.

Later the potatoes were deducted from the rations for the ducks, which ate the algae alone and fattened as rapidly as those fed normally. This was also attempted with the hens which, however, refused the algae alone, so that the potatoes had to be added and, later, swedes. The hens developed well, laid normally and their flesh had no peculiar flavour. The results were satisfactory in every way.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

1021 — **Agricultural Machinery in the United Kingdom** (2). — COURTNEY, F. S. (Consulting Engineer to the Royal Agricultural Society of England), in the *Journal of the Royal Society of Arts*, Vol. LXVI, No. 3416, pp. 403-415. London, May 10, 1918.

In describing the history of the development of agricultural machinery in the United Kingdom, the author draws attention to the fact that the double-furrow plough was developed by LORD SOMMERVILLE (1802) and improved by T. PIRRIE (1867). It was used for a number of years, but it fell into disuse until the last 20 or 25 years.

As early as 1866-67 the Royal Agricultural Society made an inquiry on the subject of steam cultivation, and a most interesting report gives details of the work done, which was about 6 acres *per diem*. Direct haulage of the plough by the engine was tried as early as 1865, but it was abandoned owing to the soil-packing caused by the engine. Of all the cable haulage systems, the one that has maintained its position is the double-engine system, which is still pre-eminent for efficiency. Out of 540 sets of double-engine sets at work in England, 267 are over 40 years old, 99 between 30 and 40 years old, 13 between 20 and 30 years old, 28 between 10 and 20 years old, and 133 under 10 years old. The author next considers

(1) For the utilisation of algae for feeding purposes see R. March, 1918, No. 320. (Ed.)

(2) Paper read before the Royal Society of Arts at London.



the internal-combustion tractor and refers to the interesting paper by Mr. LEGROS, entitled "Traction on Bad Roads or Land" (1); he then deals with cultivators, scarifiers disc-harrows, and rotary diggers (a machine of this type was patented in 1857). After dealing with harrows, rollers, seed drills, potato planters and diggers and manure distributors, the author passes to mowing and reaping machines, harvesters, threshing machines, straw elevators, straw trussers and presses, the history of which he gives as well as the improvements they have undergone and the driving power they require. In 1849 the Royal Agricultural Society held its first trial of portable engines, built somewhat on present lines, *i. e.*, with locomotive-type boiler and horizontal engine. In 1850, as the result of further trials it was found that the engines were much improved owing to better design and the use of increased steam pressure. In 1872 still greater improvements were found.

After describing the development of road traction for carrying agricultural produce, the utility is shown of applying water and electric power to agricultural purposes. In comparison with other countries there is relatively little water power available in Great Britain, but the author advises farmers to utilise as fully as possible any such water power that is available in their district.

**1022 - Hints on the Use of an Agricultural Tractor.** — Extracted from *La Journée*, in the *Bulletin Mensuel de la Chambre Syndicale des Constructeurs de Machines Agricoles de France*, No. 3, pp. 143-144. Paris, May, 1918.

It is important, in the first place, that the field of action of the tractor should not be too wide. If it is true that the majority of tractors are well sprung nowadays, it is none the less true that their chief use is not that of running about on the road. First, these journeys waste time, petrol and oil, and end by over-working if not damaging the machine. This results in time wasted, expensive repairs, the machine being held up, and the delay of urgently-needed work, without considering that all these journeys and delays considerably decrease the daily yield of the machine and that the extra cost due to running on the road, increases the bill of the tractor. This means a higher cost for ploughing an acre, the price in reality falsified by the bad use of the tractor. For example, a 20 H.P. tractor working on an 20-acre field at the rate of 5 acres per day, will, by long, frequent journeys, decrease its yield to 2.5 and 3.7 acres, a yield which does not justify the use of a tractor.

The tractor should also be used intensively, *i. e.*, night and day, weather permitting, so as to increase its yield. In bad weather, animals should be used to do the work. It is true that with the use of chain-track tractors and the tractors used in electroculture, the slipping of the wheels in wet soil is avoided.

Another point worth considering is that tractors do not give their full yield unless they are used with such implements as are suitable to them, which is not always the case.

(1) Summarised in *R.*, July, 1918, No. 803. (*Ed.*)

For agricultural work other than ploughing, the full power of the tractor should be used so as to obtain the best yield. Thus, a 20 H. P. tractor hauling a single binder will not give a good yield; two or more binders should be hauled at once.

Similarly, light work is best done by draught animals. The tractor is not meant to do away with draught animals, but to do better than them, more quickly and cheaply, and where animal traction is obviously insufficient to attain the desired end.

These hints will be specially useful to agricultural groupings formed for mechanical cultivation.

1023 - **The Dirube and Sabaria System of Cable Traction Applied to Agriculture.** — GIAGNONI, C., in the *Revista de la Liga Agraria, Asociación Nacional*, Year XXI, Vol. XX, Nos. 9 to 12, pp. 183-193. Buenos Ayres, September to December, 1917.

With previous systems of cable traction (FOWLER and DEBAIN, HOWARD and FISCHER), nearly 25 % of the power is lost in overcoming a series of passive resistances, which, however, are said to be eliminated in the DIRUBE and SABARIA system of traction. In this the machine moves to the end of the furrow carrying with it the traction platform to which the anchored cable is attached. Meanwhile the steel cable rolls on a drum coupled to the engine in such a way that the remaining part of the cable lies on the furrow. After this the operation recommences for the next furrow up to the anchorage already prepared on the opposite headland. In this way the resistance due to pulleys and cables is avoided, thus giving an efficiency of 88 to 92 %. The inventors have patented both the machine and the fuel, which is a gas. The machine has a pull of 45 H. P.; it weighs 8 800 lb.; works a breadth of 131 in. and a depth of 6 in.; the coefficient of circular friction is 0.15; the tractive effort per sq. dm. is 60 kg., the work per hour (10 hour day with 8½ hrs. actual work) is 2.35 acres; actual work per 10-hr. day is nearly 20 acres. A driver and one assistant are required. The machine with all accessories (platform and engine, balance plough, about 5 000 ft. of metal cable, anchor, etc.) is 12 250 paper pesos (about £ 1 078). The fuel (a patent gas) is consumed at the rate of 500 gm. per H.P.-hour; it costs 25 pesos (£ 2.2s.) per metric ton. Allowing 236 working days per year, the author finds that the cost of ploughing 1 hectare is 4.02 pesos. (about 2 s. 10 d. per acre).

The inventors have also built a 60 H.P. model. They intend to exploit their invention not by selling the machines but by hiring them out.

1024 - **Trials of Disc-Harrows with Tractors, in France.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year XCVII, Vol. CXXIX, n° 2, pp. 313-319 + 8 Figs. Paris, March-April, 1918.

With tractors turning the last furrows it is often necessary to use teams for scarifying and harrowing; these teams can be replaced by double disc-harrows working over a large width and thus doing much work. They are also very suitable for preparing the soil for autumn or spring sowing by replacing the scarifying and harrowing. A seed drill

or a broadcaster may even be mounted on the disc-harrow, thus sowing during the same operation, should the state of the soil permit it.

The author deals with trials with 2 ordinary Osborne disc-harrows; on light soil that had been fallowed, with a 16 HP Mogul tractor and a 14 disc harrow, about 53 820 sq. ft. are worked per hour with a consumption of 9.9 lb. of petrol per acre; on recently ploughed land with the same machines, about the same area is cultivated (53 389 sq. ft.) with a consumption of 12.4 lb. of petrol per acre. The speed was 3 662 yards per hour on fallow and 3 692 yards on recently ploughed land.

After describing the double disc-harrows (I) with smooth and toothed discs built by M. PILTIER of Paris, the author gives the results of the 1917 trials, using a double disc-harrow and a seed-drill: —

	I.	II.
Average depth cultivated in inches. . . . .	2.95	4.4
Average traction in lb. . . . . total	1026.08	1288.32
"    "    lb. per sq. dm (= 0.1 sq. ft.) . . . . .	47.74	41.8
"    "    lb. per disc. . . . .	31.9	40.26
Quality of the work. . . . .	Very good. Excellent	

The angle of each disc with the direction of traction was 77° in the first trial and 74° in the second.

Under ordinary conditions the smooth discs work quite well. The toothed discs might be reserved for soil liable to cake strongly; as regards this point the author has not sufficient information to allow him to give any definite information.

1025 — **The Marti Earth-Grab.** — GACHET, A., in *La Torre Vaudoise*, Year IX, No. 35 pp. 323-324 + 2 Figs. Lausanne, Sept. 2, 1918.

The Landed-Estate Improvement Society of Bioley-Orjulaz (Canton of Vaud, Switzerland) uses an earth-grab made by M. F. MARTI, of Berne, for constructing drainage canals. The earth-grab is worked by a movable steam crane. The grab is let down into the ground, into which it is driven by its own weight; the completeness of the filling depends on the nature of the ground. The steam engine then draws up the grab by means of the crane cable until the pawls on the grab engage in an automatic opening device. The grab is then let down; it opens but remains suspended by the pawls engaged in the release. When opened and emptied it is lifted slightly; the pawls release automatically and the grab can be let down again. The earth is emptied on the side of the canal for, while the crane is lifting the grab up, the machine is turned to the right or left. The grab runs along rails, which are moved forward as the work continues. The height of fall depends on the height at which the opening device can be attached to the arm of the crane.

A machine similar to that described is being used for making embankments at Eau-Froide (Canton of Vaud); the contract price is 1 franc per cubic metre; the earth-grab can dig and load 150 cubic metres a day. At

(1) See *R.*, May, 1918 No. 561. (Ed.)

Bioley-Orjulaz, the contractor receives the same price for work done with the machine or by hand.

1026 - **Machines Used for Harvesting Cereals in the Argentine.** — FERRÉ, J. A., in *Ministerio de Agricultura de la Nación, Dirección General de Enseñanza e Investigaciones Agrícolas, Sección Escuelas Prácticas y Viveros*, pp. 1-103 + 100 Figs. Buenos Aires, 1917.

An illustrated description of the working parts of mowers, reapers, binders, simple headers ("espigadoras"), binders-headers, etc.

In the Argentine the most commonly used makes are: the McCORMICK, DEERING, JOHNSTON, OSBORNE and CHAMPION reapers, usually cutting a 65 or 71 in. swathe; the McCORMICK, DEERING, JOHNSTON, OSBORNE and "Acme" binders, cutting 59 to 95 in.; the McCORMICK, DEERING, JOHNSTON, W. WOOD, CHAMPION headers, usually cutting 142 in.; the "La Golondrina", McCORMICK, OSBORNE, "Acme", DEERING and JOHNSTON binder-headers, cutting 142 in.; the DEERING, CRESCENT, "La Golondrina", "La Australiana" combined headers and threshers, those most used cutting 71 in., 82 in., 95 in., and requiring a team of 8 horses. By changing horses the full width of the machines can be used, thus doing 12.35 and 18.5 acres per day of 10 hours' actual work.

1027 - **The Chiesa Drier with Multiple Recipients.** — TARCHETTI, A., in *Il Giornale di Riscoltura* (Organo Mensile della R. Stazione Sperimentale di Riscoltura e delle Colture Irrigue, Vercelli), Year VIII, No. 4, pp. 54-58 + 2 Figs. Vercelli, April 30, 1918.

The author describes a new type of drier for rice and maize, made by C. CHIESA, of Milan, and sold under the name of "Automatic drier with multiple recipients". It includes 2 or more recipients, generally all of one size; the yield of the machine depends on the number of recipients. In the movable type described in the present article, there are 2 recipients; in the fixed type there are 3 or more. These machines can be worked by hand or by power.

The build of the new drier is the same as the old CHIESA type or like the ordinary type with vertical chambers or cells. In the new type, however, 2 or more machines of the old type are placed one above the other and provided with shorter vertical chambers.

In the movable type, there are 2 rows of chambers, or two superimposed recipients supported by a strong wooden frame. Under each recipient there is a horizontal, oscillating tray that carries the rice from one recipient to another placed underneath; under the last there is an inclined plane over which the grain passes into a hopper and fills the sacks.

The recipients are rectangular (13 ft. long by 3 ft. 3 in. wide and 8 in. deep) and divided into 24 cells.

The warm air from the stove passes into the recipients, whence a fan distributes it in the cells filled with grain, through which it passes into the open air. As the grain passes from the upper recipient into the lower one it is mixed, thus exposing it uniformly to the warm air. In the new drier the warm air passes vertically through the grain to escape at the

surface of the recipient ; on the contrary, in the old types, the air passes horizontally through the thickness of the cell.

According to the maker, the machine produces 59 cwt. of dry rice and 88.6 cwt. of dry maize per 24 hours, with a consumption of 1 H.P. per recipient ; thus the movable 2 recipient type inspected by the author produces 118.1 and 177.1 cwt., with a consumption of 2 H.P.

1028 - **The Use of Potato-Drying Plant in Rhodesia.** — NOBBS, E. A. (Director of Agriculture), in *The Rhodesia Agricultural Journal*, Vol. XV, No. 2, pp. 126-135 + 2 Tables. Salisbury, Rhodesia, April, 1918.

Considering the possibilities of exporting Rhodesian potatoes to England and owing to the impossibility of sending fresh potatoes such long distances, the author advises that they should be dried and to that end describes two British systems together with the plant necessary. The first system, that of JAMES MILNE & Son. Ltd., Milton House Works, Edinburgh, who have supplied a number of potato-drying plants to the Food Production Department in England, consists in steam-cooking the washed potatoes and passing them, by a rough crushing process, over a special type of drying machine. They are washed in a canal, about 2 ft. wide, 2 ft. deep and about 100 ft. long, with a fall of less than 1 %. A good flow of water enters with the potatoes and removes most of the sand and dirt. At the end of the canal is a grating through which the dirty water and sand escape, and the potatoes shoot down into a rotary washer with a horizontal shaft. This vat has 4 partitions with holes in each through which the potatoes pass, and revolving arms agitate them constantly in their transit from end to end of the machine. The washing is perfect and the potatoes leaving this machine are taken up a slope elevator and conveyor which distributes to hoppers over the cookers and drying machines. The cookers are arranged in duplicate over each drying machine. As the cooked potatoes emerge from the steaming vessels they are roughly crushed between small rollers, and then pass between 2 much larger steam-heated cylinders, which run practically in contact one with another ; the film adhering to each cylinder dries in the course of about  $\frac{1}{2}$  revolution, and is removed by sharp knives. The drying cylinders are worked at a pressure of about 80 to 90 lb. per sq. in., and require a very special mixture of iron to be sufficiently hard and yet strong enough to resist the pressure. The flake from the drying machines is milled and sifted to remove the peel, which commands a good price as a cattle feed. The cost of the plant when installed depends on the number of machines : — £1 500, £1 800, £2 200, £2 500 for 1, 2, 3, 4 machines respectively.

The yields depend on the content of dry matter ; with 15 % of dry matter in a season of 25 weeks of 60 hours each the yields for 1, 2, 3, 4 machines are 135, 270, 405, 540 tons of flour respectively and 34, 68, 102, 136 tons of peel respectively ; with 25 % of dry matter for the same season the yields of 1, 2, 3, 4, machines are 225, 450, 675, 900 tons of flour respectively and 56, 113, 170, 226 tons of peel respectively.

Figures are also given showing the cost of working 1, 2, 3 or 4 machines, which varies according to the cost of fuel, etc.

The second system, that of Messrs. L. LUMLY & Co., Ltd., the Minories, London, consists in evaporating the water of the potatoes in their "Invicta" fruit and vegetable dryer and evaporator, which is made in 5 sizes. It consists of a furnace for heating air which passes through an inclined chest or frame filled with trays on which are laid the potatoes, fruit or vegetables to be treated. The greatest heat is concentrated upon a tray when it first enters the machine, and each tray subsequently introduced pushes the previous one into a lower temperature. The circulation of the hot, dry air ensures rapid desiccation of the outside, so that colour and flavour are unimpaired. By this process thin-sliced potatoes can be rapidly changed into a hard, light, dry form which will keep and bear freight to distant points for further manufacture or consumption.

Beside these systems the author says there are many others, duly protected by patents, such as those of H. G. BENJAMIN, New York, and the ALLIANCE VEGETABLE Co., Ltd., London.

1029 - **New Applications of Artificial Cold.**—FICHET, A., in *Le Génie Civil*, Year XXXVIII, Vol. LXXXII, No. 22, pp. 396-399 + 9 Figs. Paris, June 1, 1918.

Owing to present-day needs the application of cold to industrial purposes has much increased, especially in the way of constructing cold-storage motor-vans and small cold-storage vehicles for the use of the armies in the field, for preserving vaccines, serums, meat, perishable food-stuffs, and, recently, the construction of new types of cold-storage trucks that are an improvement over those previously used. These different applications of cold have been made possible by the use of the AUDRIFFEN-SINGRÜN refrigerator which is absolutely automatic, not requiring a mechanic to attend to it, as the machinery is enclosed in a hermetically sealed case.

This refrigerator consists of two hollow metal balls joined by a shaft whose end bears a pulley serving to give a rotatory movement. One ball acts as a freezer, the other as a condenser. These are placed on two tanks, one containing water and the other a non-freezing brine. When the apparatus is rotated the brine tank cools down while the water is warmed in the other tank owing to the compression. A stream of cold water is therefore necessary, as with all freezing machines, to maintain a suitable temperature in the condensing tank.

The ordinary freezing agents — ammonia, sulphurous anhydride, methyl chloride, etc. — can be used. A detailed description of how the machine works is given, the principle being that of most refrigerators: — liquefaction of a gas by compression and cooling and evaporation of the liquid thus obtained by decompression. Owing to its extreme simplicity the machine has been used by various of the French Ministries, especially for the production of pure ice near front-line hospitals, for troops in the field in the colonies, for preserving serums and vaccines, and for cold-storage transportation. The author describes all these applications in detail. The A-S refrigerator has been adopted by the American Army Transport Commission in France for the refrigerator waggons which are to be built, on account of its simple construction, which allows it to be

left alone indefinitely without any fear of it going wrong or deteriorating. In the refrigerator waggons a small room is cut off from the length of the waggon by means of an interior wall. In this room a refrigerator of 3 000 "frigories-heure" (1) is installed with a pump and a small fan. The driving power is provided from the waggon axle. A governor prevents the speed exceeding a certain point which can be adjusted as required.

Six large brine pipes are fixed on the roof of the waggon of sufficient capacity to provide for refrigerating the waggon in case of a 12-hour stop. The fan distributes the air to assure a uniform temperature in all parts of the waggon.

The floor, roof and walls are insulated against heat by a covering of wood fibre and compressed cork slabs. To avoid too great changes of temperature, a thermostat acts on the salt pump, limiting its action when the temperature descends below  $+3^{\circ}\text{C}$ . A 10-ton waggon can carry some 8 800 lb. of goods. These waggons will be used for carrying meat and fruit from the south of France.

#### 1030 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Canada*: 182258 Disc harrower.

*Sweden*: 42146 Motorplough; 42193 Device for agricultural machines; 42194 Lifting and lowering device for agricultural machines; 42305 Scrape.

*United Kingdom*: 115198 Plough; 115328 Balance plough; 115553 Cultivator.

*United States*: 1265491 Soil pulveriser; 1265526 Ridging and pulverising machine; 1265979-1266049 Harrows; 1266328; Disc harrow attachment; 1266489 Spring toothed harrow; 1266502 Motorplough; 1266719 Agricultural implement; 1266753-1266751 Plough structure; 1266877 Gang plough.

DRAINAGE AND IRRIGATION. — *United States*: 1264906 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Sweden*: 42147 Manure spreader.

*United Kingdom*: 115491 Manure distributor.

*United States*: 1266174 Manure loader; 1266668 Straw spreader.

DRILLS AND SEEDING MACHINES. — *Denmark*: 22976 Potato planter.

*Sweden*: 42195 Mechanism for seeding machine; 42196 Seed distributor; 42426 Drill and dibbler.

*United States*: 1265323 Cotton seed dropping mechanism; 1265439 Cotton planter; 1266634 Transplanter; 1267006 Check row attachment for maize planter; 1267011 Maize planter frame construction; 1267115 Maize planter.

VARIOUS CULTURAL OPERATIONS. — *Sweden*: 42397 Horse hoe; 42428 Support for growing plants.

(1) The "frigorie-heure" represents the number of calories removed in cooling a body *i. e.*, negative calories. See MOLINARI, *Trattato di chimica generale ed applicata all'Industria*, Vol. I, p. 354. Milan, 1918. (Ed.)

*United States* : 1265296. Vine cutter ; 1265710 Cane or maize topper or header ; 1265776-1265902-1265962-1267149 Cultivators ; 1266005 Cotton chopper and cultivator ; 1266918 Wheel hoe ; 1266964 Hand wheel hoe ;

CONTROL OF DISEASES AND PESTS OF PLANTS. — *France* : 487121 Weed killer ; 487131 Sprayer for sulphating vines.

*Sweden* : 42307 Rat trap.

*Switzerland* : 78386 Sprayer.

*United States* : 1265481 Insect trap.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Denmark* : 23038 Fruit picker.

*Switzerland* : 78385 Hand mower.

*United Kingdom* : 115268 Mower.

*United States* : 1265410 Fruit picker ; 1265635 Scythe ; 1265649 Hay rake ; 1266984 Pitman connection for mower ; 1267138 Pea harvester.

MACHINES FOR LIFTING ROOT CROPS — *Canada* : 182268 Potato digger.

*Denmark* : 23059 Turnip digging machine.

*Sweden* : 42272 Root topping machine ; 42465 Root digging machine.

*United States* : 1266376 Potato digger ; 1266439 Beet harvester.

WINNOWER MACHINES. — *Sweden* : 42427 Apparatus for cleaning bilberries, peas, etc.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC. — *Canada* : 182378 Bin ventilator ; 182485 Hay press.

*Switzerland* : 78505 Hay press ; 78542-78543 Crushing, milling, grinding machine.

*United Kingdom* : 115518-115544-115547 Scutching machines.

*United States* : 1265014 Cotton seed linter ; 1265969 Hay loader ; 1266861 Packing means for silos.

FORESTRY. — *Denmark* : 22963 Portable saw driven by compressed air for felling and sawing trees.

*Switzerland* : 78504 Faggot-making machine.

TRACTION AND STEERING OF AGRICULTURAL MACHINERY. — *Canada* : 182481 Plough coupler.

*Denmark* : 22964 Windmill with multiple pairs of wings.

*France* : 487045 Anchoring system for mechanical ploughing apparatus.

*United Kingdom* : 115124-115277-115398 Tractors ; 115269 Traction engine ; 115467 Agricultural motor tractor.

*United States* : 1265114 Water motor ; 1265118 Caterpillar tractor ; 1265388-1266904-1267028-1267122 Tractors ; 1266710 Tractor hitch for harvesting machine ; 1266781 Traction attachment for motor vehicles ; 1266910 Windmill ; 1267027 Tractor coupling device.

HOUSING OF LIVESTOCK. — *United Kingdom* : 115182 Horse shoe.

*United States* : 1265534 Horse shoe.

POULTRY FARMING. — *United States* : 1265548 Chicken brooder ; 1265717 Incubator thermometer attachment.



APICULTURE. — *Sweden* : 42274 Honey extractor.

*United Kingdom* : 115355 Honey extractor.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *United Kingdom* - 115317 Baker's oven ; 115067 Potato flour.

DAIRYING. — *Canada* : 182454 Milking machine.

*Denmark* : 22999 Apparatus for lifting and emptying milkcans.

*Sweden* : 42273 Separator ; 42353 Low pressure engine for milk separator ; 42464 Suction milking machine ; 42498 Milking machine · 42499 Rolled metal bowl for a separator.

*Switzerland* : 78417 Process for storing fresh butter.

*United States* : 1265914-1266544-1266697-1266795 Milking machines.

FARM BUILDINGS AND EQUIPMENT. — *United Kingdom* : 115435 Apparatus for holding horses during shoeing.

VARIOUS. — *Canada* : 182280 Centrifugal pump.

*Sweden* : 42398 Automatic watering device for flower pot.

## RURAL ECONOMICS.

1031 - Farm Management and Farm Profits on Irrigated Land in the Provo Area (Utah Lake Valley), U. S. A. — CONNOR, L. G., in the *U. S. Department of Agriculture Bulletin* No. 582 (Office of Farm Management), pp. 1-40. Washington, D. C.; January 7, 1918.

The farm-management survey discussed in this bulletin was made in 1914. The object of the survey was to determine, approximately, the profits that farmers receive in the irrigated area of the intermountain region.

The 104 farms studied were divided into the following classes: — 1) owners; 2) owners renting additional land; 3) tenants.

The 75 records from farm owners were divided into three groups, as shown in Table I. The first group represents fruit and sugar-beet or truck farms, no one of which is as large as 27 acres, and most of them much smaller. The chief cash crops are fruit, beets and truck, other crops being quite unimportant on these small units.

The second group comprises those farms of more than 27 acres in size, but on which practically the same crops are grown as on those in the first class. Productive live stock (usually stock other than work animals) is of but minor importance in either division. The farmers operating more than 27 acres derive a greater proportion of their crop receipts from grain, hay, and sugar beets than from fruit. Considerably more than half of the total receipts comes from the sale of crops in both of these groups.

The third group comprises the live-stock farms from which records were secured. Practically half of the total receipts on these farms comes from the sale of stock and animal products, while only a little more than half of the total receipts comes from the sale of crops. The most important cash crop is the sugar beet, and fruit is a minor consideration if present.

TABLE I. — *Average area, capital, receipts, expenses, farm income, and labour income on 75 farms operated by their owners (Utah Lake Valley).*

Item	Group I (26 small farms)	Group II (29 fruit and beet farms)	Group III (20 livestock farms)	All farms
Size of farms . . . . . Acres	16.48	77.20	106.65	63.99
Tillable area per farm . . . . . »	15.04	56.64	68.06	45.26
Crop area per farm . . . . . »	13.34	46.05	47.81	35.18
Capital . . . . . Dollars	6 142	13 337	16 507	11 688
Receipts . . . . . »	1 311	2 460	3 793	2 417
Expenses . . . . . »	654	1 195	1 574	1 105
Farm income . . . . . »	657	1 265	2 219	1 312
Labour income . . . . . »	350	598	1 394	728

Table II presents the results from 22 farms where the operator owns an area which he deems too small for profitable farm management and rents additional land. This method of operation is becoming more and more general in this region as elsewhere, with the rise in land values. It represents a step midway between tenant and owner, and is very effective in enabling men with limited capital to increase their labour income with but a small increase in their investment. The first group in Table II, with but three-fifths as much capital as the small owners in Table I (\$3 597 as against \$6 142), made considerably more labour income (\$398 as against \$ 350). They raised but little fruit, devoting a large part of their crop area to sugar beets. The size of farm and the crop area is a little larger than in group I, Table I.

TABLE II. — *Average area, capital, receipts, expenses, farm income, and labour income on 22 farms operated by owners renting additional land (Utah Lake Valley).*

Item	Group I (8 small farms)	Group II (14 general farms)	All farms
Size of farm . . . . . acres	20.03	113.25	79.35
Farm area owned . . . . . »	8.03	89.18	59.67
Additional area rented . . . . . »	12.00	24.07	19.68
Tillable area per farm . . . . . »	18.59	47.62	37.07
Crop area per farm . . . . . »	17.00	43.70	33.99
Capital . . . . . \$	3 597	8 041	6 425
Receipts . . . . . \$	1 026	2 197	1 770
Expenses . . . . . \$	448	1 095	859
Farm income . . . . . \$	578	1 102	911
Labour income . . . . . \$	398	700	590

The second division in Table II comprises 14 farms comparable to those of the same group in Table I. With less than two-thirds as much

capital, they make practically one-fifth more labour income than the larger owners operating fruit and general farms.

The last group in Table II shows the results for all the farmers renting land in addition to the area owned.

These farms are compared with the last group in Table I which presents the average for all farms operated by their owners. The average tillable and crop area in the two classes under discussion is a proper measure of size.

On somewhat smaller farms, and with a little over half as much capital as the average owner, the farmers renting additional land made an average labour income of \$ 590, or nearly six-sevenths as much as that of the straight owners (\$ 728). The greater proportion of live-stock on farms run by owners accentuates the difference in labour income in their favour.

The average labour income of all the owners and owners with additional land rented is \$ 697. The average capital is \$ 10 096. This compares favourably with returns from a similar size of business in other parts of the country.

TABLE III. — *Average area, capital, receipts, expenses, farm income and labour income on 18 dairy farms (Utah Lake Valley).*

	Average		Average
Size of farm . . . . Acres	119.46	Receipts . . . . . Dollars	4 227
Tillable area per farm. »	82.88	Expenses . . . . . »	1 872
Crop area per farm. . »	57.46	Farm income. . . . »	2 355
Capital . . . . . Dollars	18 562	Labour income . . . »	1 427

TABLE IV. — *Average area, capital, receipts, expenses, farm and labour income on seven tenant (rented) farms (Utah Lake Valley).*

	Farm	Tenant	Landlord
Size of farm . . . . . Acres	89.08	—	—
Tillable area per farm. . . . . »	79.11	—	—
Crop area per farm . . . . . »	58.23	—	—
Capital . . . . . \$	—	\$ 1 117	\$ 17 469
Receipts. . . . . »	—	2 118	1 167
Expenses . . . . . »	—	1 050	589
Farm income . . . . . »	—	1 068	1 028
Labour income . . . . . »	—	1 012	—
Per cent on investment . . . . . »	—	—	5.793

Table III presents the average of all the dairy farms included in the survey. Not all are operated by owners, there being two tenant farms included and two which are operated by owners with additional land rented. These are handled statistically as though run by straight owners, the operators being charged with the landlord's expenses, credited with

TABLE V. — *Distribution of farm receipts and of crop receipts on farms operated by their owners and on farms whose owners rent additional land.*

Source of receipts	On 75 farms operated by their owners				On 22 farms operated by owners renting additional land			Average (97 farms)
	Group I (26 small farms)	Group II (29 beet and fruit farms)	Group III (20 live-stock farms)	Average (75 farms)	Group I (8 small farms)	Group II (14 general farms)	Average (22 farms)	
	%	%	%	%	%	%	%	%
Crops . . . . .	58.2	60.2	24.9	44.6	63.7	47.8	51.2	46.2
Stock . . . . .	4.0	4.2	5.2	4.9	2.5	5.6	5.0	4.6
Stock products . . . . .	4.0	3.5	45.0	21.0	3.1	15.3	12.7	19.6
Miscellaneous . . . . .	11.2	5.7	1.4	4.8	14.0	4.8	6.8	5.2
Increase of inventory . . . . .	22.6	26.4	23.5	24.7	16.7	26.5	24.3	24.4
	\$	\$	\$	\$	\$	\$	\$	\$
<i>Total receipts . . . . .</i>	<b>1 311</b>	<b>2 460</b>	<b>3 793</b>	<b>2 417</b>	<b>1 026</b>	<b>2 197</b>	<b>1 770</b>	<b>2 271</b>
Maize . . . . .	—	—	0.4	0.1	—	—	—	0.1
Potatoes . . . . .	7.5	2.8	4.6	4.3	13.3	8.0	9.4	5.3
Wheat . . . . .	1.1	5.3	0.6	3.1	6.0	4.6	5.0	3.5
Oats . . . . .	—	0.3	0.1	—	—	2.0	1.4	0.5
Hay . . . . .	0.6	6.7	2.1	4.2	0.6	4.3	3.3	4.0
Beets . . . . .	21.2	26.9	82.9	38.4	72.4	60.0	63.5	43.4
Truck crops . . . . .	8.5	4.1	1.4	4.6	3.4	8.3	7.0	5.1
Apples . . . . .	21.2	11.2	6.2	12.4	3.2	5.0	4.4	10.9
Peaches . . . . .	23.0	15.6	0.5	13.9	—	5.3	3.9	11.9
Other fruit . . . . .	16.0	24.8	0.9	17.2	1.1	2.5	2.1	14.1
Miscellaneous crops . . . . .	0.9	2.3	0.3	1.6	—	—	—	1.2
	\$	\$	\$	\$	\$	\$	\$	\$
<i>Total crop receipts . . . . .</i>	<b>763</b>	<b>1 481</b>	<b>945</b>	<b>1 089</b>	<b>653</b>	<b>1 049</b>	<b>905</b>	<b>1 049</b>
<i>Distribution of farm expenses.</i>								
<i>Items of expense . . . . .</i>	%	%	%	%	%	%	%	%
Paid labour and board . . . . .	22.2	20.4	25.2	22.3	15.1	18.8	18.2	—
Family labour . . . . .	9.5	15.2	13.9	14.0	8.5	10.0	9.8	—
Improvement and new equipment . . . . .	22.2	24.6	17.0	21.0	—	19.9	16.1	—
Repairs . . . . .	3.6	4.3	3.7	3.9	8.5	3.5	4.4	—
Feed . . . . .	11.5	6.6	14.1	10.5	9.8	7.8	8.1	—
Horseshoeing . . . . .	1.5	1.2	1.2	1.2	1.3	1.2	1.2	—
Seed and fertilisers . . . . .	2.2	1.6	0.5	1.3	1.1	1.1	1.2	—
Spray material . . . . .	2.2	2.1	0.3	1.4	0.4	0.9	0.8	—
Machine work hired . . . . .	3.1	2.5	2.7	2.7	6.9	2.9	3.7	—
Interest, taxes, etc. . . . .	10.9	12.0	11.1	11.4	35.2	22.8	25.1	—
Miscellaneous (including decrease inventory) . . . . .	6.4	6.7	4.1	5.4	3.6	4.8	4.4	—
Stock purchased . . . . .	6.7	2.8	6.2	4.9	9.6	6.3	7.0	—
	\$	\$	\$	\$	\$	\$	\$	\$
<i>Total expenses . . . . .</i>	<b>643</b>	<b>1 195</b>	<b>1 574</b>	<b>1 105</b>	<b>448</b>	<b>1 095</b>	<b>859</b>	—

the corresponding receipts and interest on the landlord's investment deducted from the farm income to secure the labour income.

Table IV presents the results secured from 7 farms operated by tenants. The tenants made a labour income of \$ 1 012, and the landlords 5.79 % on their investment.

*Renting compared with buying.* — From the preceding tables it seems very clear that the farmer with limited capital should rent rather than buy land in this area. The prevailing rate of interest on farm mortgages is 8 % (1914). The average owner of the 22 renting additional land had the use of \$4 447 in real estate belonging to the landlords, and paid only 4.5 % for it (\$ 182). The tenants paid less than 6 % on the average, but with only \$ 1 100 owned capital they made labour incomes much larger than the farmers in Table II or in the first two groups in Table I.

*Distribution of receipts.* — Table V shows the percentage distribution of farm receipts under the different headings (crops, stock, stock products, miscellaneous including outside labour, and increase of inventory less decrease) as well as the percentage distribution of crop receipts and of expenses.

*Work horses.* — The data concerning the number of work horses per farm and the crop acres per horse are presented in Table VI. The small farms have 1.94 work horses and only 7.32 acres of crops per horse. This shows a relatively low efficiency of the farm draft. With the total cost of keeping a horse a year ranging from \$ 70 to \$100, the inefficient use of farm draft on small farms represents an appreciable reduction of the labour income unless the horses can be used in idle periods at outside work. The average charge per crop acre for horse labour would therefore range between approximately \$ 6.40 and \$ 9.

TABLE VI. — *Number of work horses and crop area per horse (Utah Lake Valley).*

Farm group	Number of farms	Number of work horses	Crop area per horse acres
Small farms. . . . .	34	1.94	7.32
General and fruit farms . . . .	49	3.71	12.14
Live stock farms . . . . .	21	4.60	11.30
Total or average . . . . .	104	3.31	10.98

*The farmer's labour and the influence of outside labour on labour income.* — An estimate was obtained from each farmer on the values of the work done by him for that year. The average of all these estimates was \$ 429, which is considerably higher than the average labour income earned by the small owner, or small owner with additional land rented. The actual wages paid to dependable men by the year were frequently

higher than the estimates of the farmers as to the value of their own year's work. These wages usually range (1914) from \$ 420 to \$ 480 per year.

The importance of outside labour in increasing the labour income of the small operators is shown in Table VII. The size of business on these small Utah farms is comparable with farms very much larger in area in non-irrigated sections. The intensive type of farming followed on irrigated land calls for a labour supply commensurate with the size of business, but the operator and his family are often confronted with slack periods of considerable duration during the crop growing season, because the farms are not large enough to permit a widespread adoption of enterprises which would call for labour in the idle periods. The small farmers in the Provo area took advantage of these periods of farms inactivity to earn large additions to their farm receipts. An interurban trolley line built into Provo created a much greater demand for man and team labour than ordinarily exists in this section. These receipts from outside labour increased the labour incomes by more than 50 % in the case of the small owners and small owners with additional land rented.

TABLE VII. — *Importance of outside labour in increasing income on small farms (Utah Lake Valley).*

Item	Group I (15 small farms with 20 % or more of receipts coming from outside labour)	Group II (26 small farms (owners) showing amount of receipts from outside labour)	Group III (8 small farms (owners) with additional land rented showing receipts from outside labour)	Group IV (29 large fruit farms and beet farms (owners) showing receipts from outside labour)
Size of farm . . . . acres	18.06	16.48	20.03	77.20
Crop area per farm . . "	14.25	13.34	17.00	46.05
Capital . . . . . \$	5 362	6 142	3 597	13 337
Receipts . . . . . "	1 176	1 311	1 026	2 460
Labour income . . . . "	430	350	398	598
Receipts from outside labour . . . . . "	301	141	135	96
Percentage of labour income from outside labour . . %	70	39	34	16

*Results by type of farming as well as by size.* — In the preceding tables the various data and the returns for work done have been presented by size of farm. In Table VIII they are presented by type of farming followed. All the farms were tabulated which could be used in the six classifications of (1) small fruit, (2) small general, (3) large fruit, (4) large general, (5) dairy and (6) poultry farms. In arriving at the amount of labour used the value of extra labour hired was all reduced to a man-time basis at \$ 2 per day, the regular daily wage. When members of the farm family worked the value of their labour (above their board) was reduced to man time at the prevailing rate of wages for hands hired by the month.

TABLE VIII. — *Labour used on different types of farm and the returns for labour.*

	Small fruit farms	Small general farms	Large fruit farms	Large general farms	Live-stock farms	
					Dairy	Poultry
Number of farms . . . .	16	18	17	24	18	4
Average per farm :—						
Acreage . . . . .	17.47	17.18	51.2	62.08	119.50	8.87
Crop acreage . . . . .	14.29	14.12	41.08	45.65	57.46	8.00
Capital . . . . .	\$ 6 248	6 400	13 915	13 125	18 562	6 046
Crop sales . . . . .	\$ 804	700	1 630	2 311	1 088	278
Stock sales . . . . .	\$ 62	30	206	103	235	160
Stock product sales . . .	\$ 47	50	108	146	1 745	859
Miscellaneous receipts . .	\$ 155	140	159	105	50	—
Labour income . . . . .	\$ 302	383	611	646	1 427	483
Months of man labour used	17.24	14.46	24.57	20.29	30.75	15.15
Animal units . . . . .	4.33	4.31	9.25	8.81	31.60	10.60
Grain { Acres . . . . .	1.80	3.33	4.78	15.25	12.11	2.50
{ bushels . . . . .	68	140	196	467.50	527	110
Hay and fodder { acres . .	3.10	2.70	17.79	11.67	30	1.25
{ tons . . .	9.66	8.50	52.40	37.42	102	5.25
Beets { acres . . . . .	0.38	3.42	0.76	11.96	10.37	2.10
{ tons . . . . .	6.00	86.20	10.60	182.92	194.25	41.30
Fruit { acres . . . . .	6.51	1.70	14.55	3.80	2	1
{ bushels . . . . .	1 542	180	2 865	512.38	231.5	184.5
Non-bearing fruit . . . acres	1.94	0.17	5.00	1.85	0.35	0.4
Other crops . . . . .	1.56	1.58	1.77	2.98	3	0.6
Crop area in intensive crops % . . . . .	72.7	62.8	53.8	45.1	27.5	51.2
Crops area per man . . . acres	10.0	11.7	20.1	27.0	22.3	6.34
Months of labour per crop acre . . . . .	1.206	1.024	0.598	0.444	0.537	1.894
Labour income per month of labour . . . . .	\$ 17.52	26.48	24	31.83	46.41	32.54
Number of work horses per farm . . . . .	1.9	1.97	3.7	3.4	5.2	1.5
Crop area per work horse acres . . . . .	7.52	7.17	11.10	13.43	11.01	5.33

These results show that the type of farming followed, as well as the size of business, is an important determining factor in the net return to the large orchardist, while in the case of the general farmers size of business is the chief factor in their net returns. The size of business in an important factor in the large net return on the dairy farms, but the type of farming appears of equal importance. Most of the labour used on these farms works longer hours than on the other types and the labour is performed on enterprises all of which give good returns.

In connection with the study of the type of farming as presented in

Table VIII, it is particularly interesting to analyse the data presented in Table IX in which the labour requirements of the important crops grown on these farms are presented in detail, with special reference to extra days of man labour which are given in the footnotes. By consulting these two tables a good idea can be secured not only of the farm business as a whole but also of the demands on the time of the operator in producing the different crops.

TABLE IX. — *Labour requirement of crops.*

Crop	Winter 96 days 46 avail- able	March 1 to May 1 60 days 35 avail- able	May 1 to July 1 61 days 42 available	July 1 to September 1 62 days 50 available	September 1 to November 1 61 days 42 available	November 1 to December 1 30 days 20 available	Total
<i>Days per acre of man labour.</i>							
Strawberries . . .	1.50	0.17	36.04 <sup>(1)</sup>	2.67	—	—	40.38 <sup>(1)</sup>
Raspberries . . .	1.50	8.17	7.33	44.00 <sup>(2)</sup>	—	—	61.00 <sup>(2)</sup>
Peaches . . . . .	—	6.24	1.75	3.13	22.00 <sup>(3)</sup>	0.50	33.62 <sup>(3)</sup>
Prunes . . . . .	—	5.88	3.20	0.88	22.00 <sup>(5)</sup>	0.50	32.46 <sup>(5)</sup>
Pears . . . . .	—	5.67	2.25	4.38 <sup>(6)</sup>	9.50 <sup>(6)</sup>	—	21.80 <sup>(6)</sup>
Apples . . . . .	—	4.92	1.75	3.28	14.00 <sup>(7)</sup>	—	23.95 <sup>(7)</sup>
Alfalfa . . . . .	—	0.17	0.83	1.03	0.83	—	2.86 <sup>(8)</sup>
Canning pea . . .	—	1.54	4.50	3.50	—	—	9.54 <sup>(9)</sup>
Small grain . . .	—	0.82	0.35	1.38	—	0.67	3.22 <sup>(11)</sup>
Snap beans . . .	2.00	1.00	1.94	26.25 <sup>(12)</sup>	—	—	31.19 <sup>(12)</sup>
Tomatoes . . . .	1.50	2.10	5.07	15.67 <sup>(13)</sup>	12.00 <sup>(13)</sup>	1.00	37.34 <sup>(13)</sup>
Potatoes . . . . .	1.50	2.90	2.09	1.15	4.00 <sup>(14)</sup>	1.00	12.64 <sup>(14)</sup>
Onions . . . . .	1.50	3.17	5.84	2.67	21.20 <sup>(15)</sup>	3.66	38.04 <sup>(15)</sup>
Sugar beets . . .	2.00	0.97	3.97	1.75	6.25 <sup>(17)</sup>	1.00	13.94 <sup>(17)</sup>
<i>Days per acre of horse labour.</i>							
Strawberries . . .	3.00	—	5.67	0.50	—	—	9.17
Raspberries . . .	3.00	—	1.67	6.00	—	—	10.67
Peaches . . . . .	—	2.81	1.67	1.50	5.00 <sup>(4)</sup>	1.00	11.98 <sup>(4)</sup>
Prunes . . . . .	—	3.14	3.28	—	6.00	1.00	13.42
Pears . . . . .	—	1.67	1.33	1.00	3.00	—	7.00
Apples . . . . .	—	2.50	1.00	0.80	8.00	—	12.30
Alfalfa . . . . .	—	—	0.95	0.95	0.95	—	2.85
Canning peas . .	—	2.63	4.00	4.00	—	—	10.63 <sup>(10)</sup>
Small grain . . .	—	1.30	—	0.73	—	1.33	3.36
Snap beans . . .	4.00	1.67	1.53	3.00	—	—	10.20
Tomatoes . . . .	3.00	1.27	2.28	4.75	4.00	2.00	17.30
Potatoes . . . . .	3.00	2.47	1.08	0.25	4.00	2.00	12.80
Onions . . . . .	3.00	1.33	0.50	—	3.20	7.34 <sup>(16)</sup>	15.37
Sugar beets . . .	4.00	1.60	1.53	0.50	6.15 <sup>(18)</sup>	2.00	15.78

The figures in the above table include extra labour, mainly at harvest times, which in all cases, even when done by children, is reduced to the equivalent of man time. This extra labour is as follows:—

(1) Extra day man labour, 22.68 in third column; 0.2 in other columns.

(2) " " " " 34.50 in column 4; 0.50 " " "

(3) " " " " 20 in column 5; 1.34 " " "



- (4) Extra days horse labour, 3 (hauling).
- (5) Extra days man labour 17 in column 5; 2.28 in other columns.
- (6) " " " " 8 in column 4 and 5; 2 in other columns.
- (7) " " " " 8 in column 5; 1.50 in other columns.
- (8) " " " " 0.75 evenly distributed at each cutting.
- (9) Total extra days man labour 0.77.
- (10) Total extra days horse labour 0.2 (planting).
- (11) Total extra days man labour 0.80 (at harvesting and thrashing).
- (12) Extra days man labour 22.50 (picking by boys and girls).
- (13) Extra days horse labour 18 in columns 4 and 5 (picking mainly women and children); in other columns 1.25.
- (14) Extra days man labour 2 (digging) in column 5; 0.9 in other columns.
- (15) Extra days man labour 13.60 (digging) in column 5 (harvest mainly children); 5.33 in other columns, of which 4 are used in weeding before Sept 1 (done by boys).
- (16) Extra days horse labour 2.67 (hauling).
- (17) Extra days man labour, 5 in column 5 (harvesting), 1.07 in other columns includes thinning about June 1 (done by boys).
- (18) Extra days horse labour, 3.75 (hauling beets).

The factors which apparently control the income of the farmers in the area surveyed, according to the data presented in the previous tables seem to warrant the conclusion that the greatest need of the small farmers in this district is more land to work, and that diversification, also when needed, is not nearly as important as an increase in size of farm. A market crop which is more certain than fruit, particularly sugar beet, should be the proper diversification for the increased farm.

A further increase in the number of very small farms in this region seems to be unwise. About 30 acres seems to be the smallest size for efficient management without much reliance on live stock. Forty to fifty, preferably fifty acres, seems to be the smallest unit for efficient management where live stock enterprises are given a prominent place by the typical farmer. This is specially true for dairying.

The general farms which grow truck and fruit as secondary enterprises approximate the ideal cropping combination for this region.

1032 - **The Economic Results of the Overhead Irrigation of Strawberries in Illinois, U. S. A.** — ADRIAN, J., in *System on the Farm*, Vol. II, No. 4, pp. 134-135 + 1 Plate. Chicago, April, 1918.

In 1916, after having grown strawberries for 12 years without irrigation, the author installed an overhead irrigation system (1). The cost of installation was \$ 1 200 for 6 acres, or \$ 200 per acre. The water is derived from the municipal supply, and is charged for per cubic foot, the yearly cost of irrigation amounting to \$ 60 for the 6 acres. The average amount of water required for the whole area is 1400 000 gallons a year. The irrigation pipes are placed in parallel lines 50 feet apart. This distance allows the water from two parallel pipes to meet in the middle.

All the field, with the exception of 1 acre of autumn fruit, is planted

(1) See B. 1912, Nos. 486 and 627; B. 1914, No. 1090; B. 1915, Nos. 95 and 1330; R. 1917, Nos. 408 and 708. (Ed.)

with spring fruit, but, in time, the author intends to grow the autumn variety exclusively because of the greater profit obtained from it.

During 12 years the average receipts from strawberry growing without irrigation were \$ 188.56 per acre, and the average profits \$ 125.54. With overhead irrigation the average receipts per acre were \$ 542.86, and the average profits \$ 362.00.

## AGRICULTURAL INDUSTRIES.

### INDUSTRIES DEPENDING ON PLANT PRODUCTS

1033 - **A New Method for Determining the Watering of Wine** (1). — PRATOLONGO, U., in *Le Stazioni sperimentali agrarie italiane*, Vol. LI, Pt. 1-2, pp. 56-60. Modena, 1918.

The problem of diagnosing the watering of wine has not yet been satisfactorily solved, but, according to the author, it is not only possible to show watering, but, under certain conditions, easy.

The method reported in 1912 by Prof. PAGNOTTA is based on the fact that natural wine forms a saturated solution of mono-potassic tartrate and calcium tartrate. If the wine to be tested is saturated with mono-potassic tartrate and the difference between the tartrate dissolved and the added tartrate and residue determined, it should be possible to calculate the amount of water added. The author made a series of investigations into the solubility of mono-potassic tartrate and calcium tartrate in hydro-alcoholic solutions, with respect to the temperature, and content in alcohol and tartaric acid, considered as variables. He also investigated the influence on the solubility of these two salts of the chemical treatments and changes to which wine may be subjected.

The results of his study led him to believe that it is possible to show with certainty the watering of wine even with quantities as small as 5 to 10 %. It is, moreover, possible to show the presence of other prohibited matter, such as, for example, sulphuric acid, even if the amount is too small to be detected by other analytical methods. The method is not only qualitative, but also quantitative when the water added varies from 5 to 20 %. The author proposes to study the influence of changes which wine undergoes during ageing and through diseases. The method does not permit the detection of water added to the must.

The method may be outlined as follows:— The wine to be tested is saturated with mono-potassic tartrate and calcium tartrate separately, the contact of the two salts in excess being kept at a temperature of from 50-60° C. for half an hour. The excess of mono-potassic tartrate and calcium tartrate dissolved is allowed to settle by cooling, and, in the wine thus saturated, the following points are determined:— 1) the difference in the amount of mono-potassic tartrate dissolved and the two comparative acidometric determinations made with non-saturated wine and wine saturated with mono-potassic tartrate; 2) the amount of calcium tartrate dissolved, with the determination by weight of the total calcium in the wine before and after saturation.

(1) See R., January, 1918, No. 93. (Ed.)

1034 — **The Influence of the Vegetable Function of Yeast on the Yield of Alcohol; a New Interpretation of Fermenting Power.** — LINDET, L., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 22, pp. 910-913. Paris, June 3, 1918.

In a previous paper (1) the author had shown that, during alcoholic fermentation, yeast splits up the sugar it destroys into two parts: — 1) that part corresponding to the formation of the cells, to the production of glycerine, succinic acid, and carbonic acid corresponding to the respiration of these cells, etc.; this part he called "fermentation residue" but now calls "vegetable function part"; 2) that part which gives rise to the alcohol and carbonic acid corresponding to the breaking-up of the sugar (GAY-LUSSAC's formula), which is the "zymatic function part".

The results are given of new experiments in which yeast was subjected to anaerobic conditions. The influence of the food value of broth, that of the sugar concentration, of the more or less plasmolysed globules, and of the temperature of fermentation were studied.

The less yeast there is, the longer does fermentation last; the higher the proportion of sugar consumed by the vegetable function, the lower the yield in alcohol. In the experiments lowering the temperature had more influence on the duration of fermentation than on the reduction in weight of the yeast. This also holds good when the amount of yeast is increased. When a certain limit (1 in 1000 of dry yeast) is exceeded, fermentation is very rapid, but the maintenance and respiration of an excessive number of cells causes too great a consumption of sugar for the vegetable function. The origin of the yeast does not appear to influence the yield.

The fermenting power must be considered to lie in the two functions of the yeast; the amount of sugar consumed by a yeast unit for its vegetable life should be called *vegetable power*, that consumed to accomplish its zymatic function should be called *zymase power*; the total of these two represents PASTEUR'S fermenting power. In the experiments these two powers proved higher in proportion as the yeast gathered was less and fermentation continued longer. This prolongation of vegetable life, accumulating more residue, formed a larger quantity of zymase.

If these two powers, especially the vegetable power, are compared with a unit of time (24 hours), it is seen that, except when lowering the temperature hinders respiration, the weight of sugar yeast utilises to form a given weight of yeast in a given time, is practically the same under the various conditions of the experiment.

1035 — **Decortication of Wheat Previous to Milling.** — LINDET, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 19, pp. 569-573. Paris, May 29, 1918.

The attention of the Ministry of Agriculture and Food Supply has been drawn to a method by which wheat may be decorticated previous to milling so that only the kernel remains to be ground. The wheat is moistened with a small quantity of water in an Archimedian screw which conducts it to the decorticator, composed of two plates with radiating grooves.

(1) See R. Dec., 1917, No. 1218. (Ed.)

One of these plates is fixed ; the other revolves in front of the first at the rate of 300 revolutions.

A commission was appointed to examine this method and the author (professor at the " Institut National Agronomique "), who was a member of it, gives the results of the experiment.

All the results were negative. The apparatus removed only the pericarp, leaving the other three coats (seminal tegument, hyaline layer and protein cells) which are the most important. The wheat thus decorticated gave less flour, and even less bran, than the control wheat, the loss being about 2.49 % instead of 1.10 %, the normal figure. The bran of the wheat treated by the new process contained more adhering flour, the flour less gluten, and the bread made from it was brown and tasted of bran, *i. e.*, had the taste of all bread made with wet wheat. The skins which come from the apparatus as paste are not saleable.

The author concludes that this method and all others based on the same principle can give no satisfactory result.

1036 - **Oil of *Pistacia Lentiscus*** — *The Cyprus Agricultural Journal*, Vol. XIII, Pt. 2, pp. 28-29. Nicosia, April, 1918.

In Cyprus an edible oil (shinia oil) is extracted from the fruit of *Pistacia Lentiscus*, a plant which grows wild throughout the island. Although the consumption of this oil has increased greatly of late years its preparation only constitutes a small industry of the poor classes, who manufacture it for domestic use, and but little for commerce. The yield is about 18 %. Owing to the primitive methods of preparation it rarely keeps more than three months without turning rancid.

1037 - **Experiments on the Biological Saponification of Various Fats from the French Colonies.** — HENR, F., in the *Bulletin de l'Office colonial*, Year XI, No. 124, pp. 227-231. Melun, April, 1918.

The biological saponification of fats causes them to break up into fatty acids and glycerine under the influence of a special soluble ferment. The soluble saponifying ferments must occur in all oily seeds at the time of their germination; their action alone allows the embryo to utilise, after saponification, the oil reserves of the seed. Indeed, at the moment of germination of various fatty seeds it has been possible to determine a more or less considerable increase in the amount of free fatty acids. This breaking-up (hydrolysis) of the fat normally occurs *in vivo*; for some unknown reason it is difficult to reproduce it *in vitro*.

The soluble ferment of the castor oil seed is the only one it has been possible to isolate and make act on a certain number of fats to cause saponification. Very pure products (fatty acids and glycerine) were obtained, and the method has been adopted commercially.

The Department for the study of colonial products has studied the fats capable of being split-up and treated with castor oil ferment without having to be subjected to the different operations required for aqueous acid or alkaline saponification. The only fats on which castor oil ferment had any notable action under the experimental conditions adopted, were

oil of cotton, tea, the pericarp of aouara, the kernel of aouara, *Funtumia elastica*, *Carapa microcarpa*, *Sorindeia olessa*, and *Chrysophyllum congoense*. The fermentation action was negligible for the other fats examined, and before and after the action the proportions of acidity were either very similar or identical.

As a rule the proportion of acids formed is fairly low, and, with the exception of *Carapa microcarpa*, is rarely above the 80 or 90 % which has sometimes been found in saponification with castor oil. This may be due to the relatively high temperature at which the fermentation tests were carried out — 37 to 38°C., when the optimum temperature is about 30°. This higher temperature was indispensable to maintain the fat in the liquid condition essential to the normal progress of fermentation.

The initial acidity of the oils of the pericarp of aouara and *Chrysophyllum congoense* seems to show them to contain a saponifying ferment. The subsequent commercial utilisation of the ferments contained in the various oily seeds calls for a long series of successive studies.

1038 — **The Utilisation of Paddy in Italy at the Present Day** (1). — NOVELLI, N., in *Il Giornale di Riscicoltura*, Year VIII, No. 4, pp. 49-52. Vercelli, April 30, 1918.

Before the war paddy supplied in Italy numerous commercial varieties of rice representing as many different stages of the preparation of rice often in connection with the variety of paddy. There were varieties "mercantile" (commercial), "raffinato" (bleached), "camolino" (polished), "oleato" (polished with oil), "brillato" or "francesino" or "diamante" (coated) etc. (2). The forms representing the last stages of preparation were originally intended for exportation (which exceeded  $\frac{2}{5}$  of the production) for which rice which would keep during voyages and in hot countries was indispensable. Later they were used for local consumption, either because Italians preferred them to other varieties, or because dealers, by polishing, could better hide certain natural defects.

As is known, complete polishing reduces the yield of rice by as much as 50 % in some cases, and deprives the seed of the outer layers which are the richest in fats, albuminoids and phosphorus. In order to obtain the highest possible yield and the best food value from rice the "Commissariato generale dei Consumi" (General Food Commissariat) therefore ordered the standardisation of the different types of prepared rice, so that at the present time only one type is produced. This is neither polished with oil nor scoured and represents the commercial type, which follows on rice which is merely husked ("sbramato"). A slight percentage of small or pointed seed ("mezzagrana") is also left in this rice. The proposal to reduce the preparation of rice to the husked type has been given up because it always contains numerous silicious fragments derived from the husk and is more difficult to keep. About  $\frac{4}{5}$  of the total number of the different varieties of rice grown in Italy are of Asiatic origin, very resistant to disease, and very productive. For this very reason they have a longer vegetative period and consequently are not always entirely physiologically ripe, with the result

(1) See also *R.*, August 1918, No. 906. — (2) For these terms see *R.* October, 1917, No. 933. (*Ed.*)

that their seeds are richer in moisture. Such rice when simply husked will not, therefore, keep long.

From a point of view of their keeping qualities husked Italian rices are not equal to husked Hindoo rices, which are perfectly ripe physiologically and naturally dry. On the other hand they contain about 20% of seed with glumes which lessen fermentation but make it necessary to re-treat the imported rices to remove these glumes.

About  $\frac{4}{5}$  of the rice requisitioned in Italy at the present time gives a yield of 67 to 70 %. The small or pointed seeds ("mezzegrane"), broken rice mixed with weed seeds ("risetto") and broken rice ("pistino") are ground into flour for bread; the coarse flour ("farinaccio") is used for bread-making and the residue, sometimes mixed with that of various products, is used for preparing dressing for fabrics. The residue containing fragments too adulterated with seeds of weeds is sold to breweries, and the residue of decorticated rice ("pula") is used as a food for cattle. Investigations into the best methods of utilising the residue of decortication for the making of bread and other foodstuffs are now in progress.

1039 - **Drying Vegetables.** — VERMOREL, in *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 20, p. 613. Paris, June 5, 1918.

The author emphasises the importance of the problem of drying vegetables; and points out that the temperature in nearly all the methods adopted is from 70 to 80°C. To avoid coagulation of the albuminoids the temperature should not exceed 40 to 42°C., or the dried vegetables become so hard that they are unfit for consumption.

1040 - **"Gelso-lino" (Mulberry Flax), in Italy.** — SANSONE, A., in the *Bollettino dell'Associazione dell'Industria laniera italiana*, Year XXXII, No. 5, pp. 52-54. Biella, May 31, 1918.

Some 50 years ago a small manufactory was founded in Bergamo for making strong, resistant paper, imitating the Chinese and Japanese varieties, and using mulberry fibre; the factory, however, did not last long. Besides this the author recalls work done in his manufactory at Vittorio Veneto (Province of Treviso) by PASQUALIS, who found a method for isolating mulberry fibre, which he called "gelso-lino", for use in spinning and weaving. The author describes his full scale experiments carried out in 1906 at the works of the "Unione Concimi e Prodotti Chimici" at Bovisà, near Milan. These experiments showed that the most practical method for separating the fibre in the mulberry branches (loppings) was as follows:—Soak the branches in pools or ditches (not necessary if wood is green); crush the retted or green branches with a heavy roller on a cement, wood or tiled floor; collect the bark thus separated; crush the wet bark mechanically to separate the epidermis, which is easily powdered; sieve in a metal mesh cylinder, the fibre remaining inside, the impurities passing through the meshes; bleach with alkalies and acids, and then with a hypochlorite solution. The author carried out these experiments with the idea of finding whether mulberry fibre could be used as a cheaper substitute for jute for making sacking. Owing to the low price of jute at that time, the results were negative. However, mulberry fibre, freed

from its gummy matter and bleached, can give products of much greater value than jute. At Vittorio Veneto, PASQUALIS made pure "gelso-lino" textiles. The author advises that it should be treated to obtain more even fibres, although they are shorter, then carded; the longest fibres should be mixed with cotton, spinning wool, or hat felt while the shortest should be used as a water-absorbent. "Gelso-lino" alone or mixed with wool or cotton dyes perfectly. Two-shade effects can be obtained in the mixed tissues by means of the acid-dyes used for wool. The short fibre can be used in paper-making to strengthen paper made with inferior material. The yield of bleached fibre is from 10 to 20 % of the dry bark, *i.e.*, 2 to 5 % of the weight of branches treated.

The author points out that there are from 100 to 150 million mulberry trees in Italy. If each tree gives loppings with 100 to 150 gm. of fibre, an annual production of 15 million kg. of "gelso-lino" would be possible. The system of growing mulberry trees high, common in Italy, is not the best for fibre production. To obtain the long, uniform branches best suited for the industry, the mulberry should be grown with a low trunk as in the method usual in Japan but rare in Italy.

1041 - **The Manufacture of Paper Pulp from Dead Leaves.** — BRAMSON, K., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 853-854. Paris, May 27, 1918.

Each year in France there are from 35 to 40 million metric tons of dead leaves. To meet the country's paper requirement only 4 million tons would be necessary, which would, moreover, yield 2 million tons of useful by-products. It is easy to collect the leaves, and as they may be utilised throughout the year it is not necessary to store them. They could be transported in compressed form, but it would be better to instal works on the outskirts of the large forests where the raw material could be collected as required.

The process for making paper pulp from leaves is simple, rapid, and inexpensive. The leaves are crushed and then divided into two parts — the *veins* and *powder* (the blade falls into powder after crushing). The veins form the raw material for the pulp; they are steeped in lye for a short time, then washed and bleached, and the pulp is made.

The powder may be used as a fuel. It may be compressed into bricks with or without coal dust. Dry distillation is, however, preferable. By this method is obtained a relatively pure (porous) fuel, rich in calories (6 500 to 7 000), and easily agglomerated. At the same time are obtained a tar (which has all the properties of Norwegian tar), acetone, and pyroligneous acid. The powder may also be used as a food for cattle for, as the fibrous parts of the leaf have been removed, the assimilable, nutritive parts remain. The food value of this powder is almost equal to that of hay. Mixed with compressed molasses it given a cake as good as that of hay.

The yield of 1 000 lb. of leaves is: — 1) 250 lb. of paper pulp; 2) 200 lb. of pure fuel (or 500 lb. of food powder); 3) 30 lb. of tar, 1 lb. of pyroligneous acid, 0.6 lb. of acetone.

1042 - **The Cotton Mill Industry of the World.** — *The Indian Textile Journal*, Vol. XXVII, No. 319, p. 221. Bombay, April, 1917.

The consumption of cotton in the various countries of the world and the number of spindles in active use during the years 1901 and 1916 are given in the following table: —

	Cotton consumption Bales of 500 pounds gross Season of 1915-1916	Cotton spindles	
		1901	1916
United Kingdom . . . . .	4 120 000	46 400 000	56 400 000
United States . . . . .	7 325 000	20 800 000	33 000 000
Germany . . . . .	800 000	8 140 000	11 750 000
Russia . . . . .	2 070 000	7 900 000	9 100 000
France . . . . .	1 025 000	5 700 000	7 300 000
India . . . . .	2 040 000	5 000 000	6 850 000
Italy . . . . .	900 000	2 000 000	5 000 000
Austria-Hungary . . . . .	390 000	3 500 000	4 050 000
Spain . . . . .	400 000	1 800 000	3 200 000
Japan . . . . .	1 670 000	1 250 000	2 900 000
Brazil . . . . .	325 000	400 000	1 500 000
Switzerland . . . . .	90 000	1 300 000	1 500 000
China . . . . .	2 525 000	200 000	1 250 000
Belgium . . . . .	20 000	920 000	1 100 000
Canada . . . . .	225 000	600 000	975 000
Scandinavia . . . . .	169 000	400 000	850 000
Mexico . . . . .	85 000	300 000	550 000
Holland . . . . .	100 000	335 000	545 000
Portugal . . . . .	60 000	230 000	480 000
Other countries . . . . .	161 000	220 000	585 000
Total . . . . .	24 500 000	107 395 000	149 785 000

1043 - **The Carbonisation and Distillation of Peat, Wood-shavings, Household Waste and Other Light Organic Products.** — GALAINE, C. and HOULBERT, C., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLVI, No. 21, pp. 854-856. Paris, May 27, 1918.

Even when after the war coal-mining again becomes normal in all countries, the peat industry will have a great future before it because this product is less important as fuel than for the distillation of the peat itself or of the "tourbon" (1) as a substitute for wood in the manufacture of acetic acid, methyl alcohol, ammonia and tar, which forms the basis of so many colouring matters.

With very dense matter, such as coal, small, rectangular, elliptical, relatively narrow retorts can be used, but for peat, or light products, it is

(1) "Mr. Eckenberg of London has shown that peat heated under pressure at a temperature above 150°C. loses its gelatinous consistency and can be easily dried by compression. For purely technical reasons it has not hitherto been possible to apply ECKENBERG's method industrially. Nevertheless the product obtained therefrom has very interesting properties; it is no longer peat, but a new substance to which we give the name "tourbon". (GALAINE-LE NORMAND and HOULBERT, Sur l'exploitation économique des tourbes de Châteauneuf-sur-Rance (Ille-et-Vilaine), in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXV, No. 10, p. 337. Paris, Sept. 3, 1917). (Ed.)



necessary to use a large retort which will allow a more easy transmission of the heat from the periphery towards the centre. From their experiments the authors concluded that the best results were obtained with a revolving retort. They describe their apparatus which is constructed on the principle of roasters for organic matter (coffee, cacao, chicory, etc.), and is fitted with a recipient for collecting the distillation gases. The apparatus has three characteristic peculiarities:— 1) revolving retorts which successively bring the substances to be carbonised into contact with the heated wall; 2) perfectly continuous working; 3) easy emptying and charging with fractional separation of the distillation products.

The apparatus may also be used for the carbonisation and distillation of wood, lignite, saw-mill waste, household waste, and all more or less completely dry organic residues.

1044 — **The Four Essential Factors in the Production of Milk of Low Bacterial Content.** — AYERS, S. H., COOK, L. B. and CLEMMER, P. W. (Dairy Division of the U. S. Department of Agriculture), in the *U. S. Department of Agriculture, Bulletin* No. 642, pp. 61 + 28 Tables + 23 Figures + 6 Plates + Bibliography of 47 Publications. Washington, April, 1918.

INDUSTRIES  
DEPENDENT  
ON ANIMAL  
PRODUCTS

This paper is a new contribution to the hygienic factors influencing the bacterial content of milk. The authors wished to confirm once more the necessity of observing the well-known sanitary rules (1) by supporting them by indisputable scientific data. They made several bacterial counts of milk taken under the following conditions: — 1) sterilised utensils; 2) clean cows with clean udders and teats; 3) small-top pail.

The following data taken from the numerous tables given in the bulletin show the degree to which the cleanliness of milk is to be attributed to the observation of these principles.

1) **STERILISED UTENSILS.** — This is the factor with the greatest influence on the bacterial content of milk. Counts made from 60 samples of milk showed an average of 6 306 bacteria per cc. when the utensils were sterilised and 73 308 when they were not sterilised; the difference (67 002 bacteria) can, thus, only be attributed to the sterilisation of the utensils.

2) **WASHING THE UDDER AND TEATS.** — When the animals and barn were kept clean the bacterial counts per cc. of 65 milk samples gave the following figures:— 1) *udder and teats washed*, minimum 620 bacteria, maximum 5 400, average 2 154; 2) *udder and teats unwashed*, minimum 10 050, maximum 20 400, average 4 524.

3) **SMALL-TOP PAIL.** — The small top pail is of the ordinary type with a fixed top leaving only a small semi-circular opening near the edge. Throughout the experiment milk taken in this pail always had a much lower bacterial content than that taken in an ordinary open milking-pail whatever the other conditions were. The maximum number of bacteria per cc. in the first case was 750 000, in the second, 1 200 000.

In order the better to control their results the authors combined the various factors in different ways. Data on the contamination of milk by faeces are also given.

(1) See *R.*, May, 1917, Nos. 483 and 485. — *R.* January, 1918, No. 71. (*Ed.*)

Finally, the *effect of temperature* on the bacterial content of milk was observed. Counts were made of fresh milk kept at 4.4°, 10°, and 15.5° C. and 21.1° C. for 24 hours and 4 days. At the end of 96 hours the figures for the bacterial growth in all the samples tended to resemble each other. The optimum temperature is 10° C. or less.

The authors believe the three factors considered and the keeping of the milk at a temperature near 10° C to be the most essential conditions for the production of fresh milk with a low bacterial content, and that too much attention has often been given to other, less important factors. Moreover, these conditions may easily be observed, even in medium-sized dairies.

1045 - **The Enzymes of Milk and Butter.** — THATCHER, R. W. (Minnesota Agricultural Experiment Station) and DAHLBERG, A. C. (Wisconsin Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. XI, No 9, pp. 437-450 + Bibliography of 27 Publications. Washington, November, 1917.

The deterioration of butter during storage is often attributed to the enzymes in the buttermilk which it contains. Most investigations into the matter give little information as they chiefly deal with the chemical changes in the butter itself during storage and not its enzyme content. The following types of enzymes have been reported to be normally present in cow's milk: — an amylase, a lipase, proteases, a peroxidase, salolase, catalase, reductase, a lactose-fermenting enzyme. These results are not always in agreement.

During the summer of 1915, DAHLBERG prepared several lots of butter under carefully controlled conditions of manufacture and placed them in storage, in order to study the effect of varying methods of manufacture. He also studied the bacterial development in these butters (1). Thus excellent material was ready for a study of the enzyme content of the butter after storage, and such a study was undertaken by the authors, the results being given below.

**RESULTS.** — Proteolysis in skim milk was completely inhibited by 1 % of chloroform and by 15 % of sodium chloride. Galactase (the normal proteolytic enzyme of milk, which aids in the slow decomposition of milk proteins into peptones, amino acids and ammonia) cannot act in normal butter because of the high salt content.

In the separation of milk the factors which increased the percentage of casein in the total nitrogen also increased the galactase content. The ripening of cream did not increase the rate of proteolysis. No oxidase was found in milk or butter. Only one sample of butter out of 8 gave any evidence of lipase at the end of 4 days at 40° C. The enzyme content of butter is very small, because of the high dilution in fat. Expressed on the basis of total nitrogen the butter examined contained as much galactase as fresh whole milk, twice as much catalase, but only one hundred and sixtieth as much peroxidase. The cold storage of butter weakens the per-

(1) See WASHBURN, R. M. and DAHLBERG, A. C., The Influence of Salt on the Changes taking place in Storage Butter, *Journal of Dairy Science*, Vol. II, No. 2, pp. 114-126, 1917 (Ed.).

oxidases, but has little effect on the catalase and galactase. Enzymes are present in butter in such small amounts and under such unfavourable conditions for enzyme activity during cold storage that they need not be considered as a factor in the deterioration of butter during storage.

1046 — **The Deterioration of Condensed Milk; Estimation of its Acidity.** — DUGARDIN, M., in *Annales de Chimie Analytique*, Vol. XXIII, No. 4, pp. 83-84 + 1 Table. Paris, April, 1918.

The present large demand for condensed milk has resulted in its being manufactured with increasing rapidity. If, however, sterilisation is imperfect the milk easily undergoes a fermentation which makes it unfit for consumption. To determine this deterioration it is sufficient to estimate the acidity.

The author estimated the acidity in several samples of condensed milk of different brands. The method used was as follows: — 10 gm. of the sample are diluted in 25 cc. of tepid, distilled water (from which the  $\text{CO}_2$  has been previously removed by boiling); titration with a decinormal solution of caustic soda, using phenolphthalein as an indicator; the acidity is expressed as lactic acid per 100 gm. of matter. The results showed that the normal acidity for sweetened unskimmed milks and for sweetened skimmed milks does not exceed 0.5 gm. An acidity between 0.5 and 0.75 gm. shows a deteriorated milk. Milk with an acidity above 0.75 gm. is unfit for consumption. In this last case the boxes bulge out very much, and the contents are violently expelled when they are opened. Unsweetened milks become clotted and are difficult to dissolve in water. Sweetened milks are solid and give off a disagreeable smell.

1047 — **Bacterial Precipitins and the Detection of *Bact. botulinus* in Preserved Foods by the Thermo-Precipitation Method.** — BORNAND, M. (University of Lausanne and the Cantonal Laboratory of the Sanitary Service), in *Travaux de chimie alimentaire et d'hygiène publiés par le Service suisse de l'hygiène publique*, Vol. IX, Pt. 2 and 3, pp. 87-98. Berne, 1918.

The author reviews the work on *precipitins*, first observed in 1897 by KRAUS, who found that a typhus or cholera anti-serum in the presence of the filtrate of a homologous culture causes a precipitate. As the precipitation reaction was nearly always specific, work on the precipitins has given rise to their being put to various uses: — 1) particularly in the analysis of foodstuffs anti-serums have been prepared for identifying eggs and milk in products said to contain them; 2) in the control of meats and the determination of their nature, e. g., CLARKE (*Bull. Pasteur*, p. 731, 1914) was able to prove that meat sold in an hotel as bear's meat was in reality meat of a deer, the hunting of which was prohibited; 3) in medical diagnosis: — parasitical diseases (echinococcosis, Leishmaniosis, dourine, etc.); bacterial diseases (glanders, cerebro-spinal meningitis, human and bovine tuberculosis, etc.).

ASCOLI METHOD. — ASCOLI and VALENTI discovered that bacterial precipitogens are very resistant to heat and adapted this knowledge to a new method for the diagnosis of bacterial infections called by them the *thermo-precipitin* method; e. g., in the diagnosis of anthrax a few grams of the ma-

terial believed to be infected are placed with the physiological solution in a test tube which is left from 3 to 5 minutes in a boiling water bath. After cooling and filtering the clear liquid is placed in contact with the precipitating serum, and if the material examined is infected, a white ring is formed at the point of contact of the two liquids. Putrefaction, which impedes the search for the bacterium in direct examination, has no action in this case; thus the precipitation reaction was still positive for an infected cow, the dead body of which had been buried at a depth of about 6  $\frac{1}{2}$  feet for 45 days and had been sprayed with paraffin, and also for organs kept in alcohol for 4 months.

Control experiments showed the reaction to be specific. The ASCOLI method the value of which is recognised, has been used for the diagnosis of swine plague, tuberculosis, Malta fever, paratyphous infections, etc.

DETECTION OF *B. botulinus* IN PRESERVED FOODS. — The author wished to determine if the immunisation of a rabbit with extracts of *Bact. botulinus* would make it possible to obtain a precipitating anti-serum for this organism, and if it could be detected in preserved food by thermoprecipitation. He immunised a rabbit by sub-cutaneous inoculations in both thighs made at intervals of 3 or 4 days with extracts of a culture of the bacterium. Eight days after the last injection the animal was bled, part of the serum filtered and the other preserved with toluene. A precipitating anti-serum specific for this bacterium at ordinary temperature was thus obtained.

Taking advantage of the thermo-stability of the precipitogen the author attempted to identify the presence of the organism in question in artificially infected preserved foods: — 3 boxes of braised beef, 1 box of herrings and 1 box of peas. At the end of 5 months the lids of all the boxes except that of peas bulged considerably. When opened gases with a butyric smell were given off. A microscopical examination and cultures made from the contents of the boxes showed the presence of *Bact. botulinus*. Five grams of the contents were then treated in physiological solution by the ASCOLI method. (The filtered anti-serum has a weaker precipitating action than that kept in toluene). The results of the reactions thus produced at room temperature may be summarised as follows:— anti-serum + extract of *Bact. botulinus* culture gave a precipitate after 30 minutes; anti-serum + extract of normal preserved braised beef, no precipitation; anti-serum + extract of infected preserved braised beef and infected preserved herrings, precipitation after 60 minutes; anti-serum + extract of preserved peas, no precipitation.

It is seen that the reaction is negative with preserved vegetables (peas).

CONCLUSIONS. — 1) By injecting rabbits subcutaneously with extracts of a culture of *Bact. botulinus*, a precipitating anti-serum of this bacterium may be obtained.

2) The presence of *Bact. botulinus* may be detected in preserved meat by the ASCOLI method as a result of the thermo-stability of the precipitogen of this bacterium.

## PLANT DISEASES

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1048 - **Researches on Apple-Spot Diseases.** — BROOKS, C. and FISHER, D. F. (Bureau of Plant Industry, U. S. Department of Agriculture), in *The Journal of Agricultural Research*, Vol. XII, No. 3, pp. 109-137 + 10 Figs. + 4 Plates + Bibliography of 22 Publications. Washington, January 21, 1918.

GENERAL

The present paper deals with the effects of soil-water supply upon bitter-pit, Jonathan-spot and certain other non-parasitic spot diseases of the apple (*Malus sylvestris*). It also includes notes upon the relation of the time of picking to the development of apple-spots in storage. The authors' summary of the results is given below.

1) Bitter-pit and Jonathan-spot are to be distinguished from rosy-aphis stigmonose, drouthspot, cork, blister. Bitter-pit usually appears first as spots of dead, brown tissue in the sub-epidermal portion of the apple. These spots are associated with the terminal branches of the vascular bundles and in later stages of the disease the browning often follows the vasculars deep into the flesh of the apple. Rosy-aphis stigmonose is characterised by similar brown spots in the sub-epidermal region but the affected tissue is firmer than in the case of bitter-pit and there is no association with the vascular bundles. The early stages of Jonathan-spot are confined to the colour-bearing cells of the skin of the apple. Drouthspot is characterised by the checking of the growth at certain points on the apple without the production of any large quantity of corky tissue; fairly large areas of dead brown tissue usually occur near the surface of the apple, but sometimes are to be found deeper in the flesh; the spots are usually located in the blossom half of the fruit, which appears to be more susceptible after it is some one-third grown. Cork differs from the drouthspot in the presence of comparatively large spots of brown corky tissue, and in the fact that these are usually rather deeply seated in the flesh of the apple. Blister is a superficial lesion associated with cork and characterised by its blister-like appearance.

2) Drouthspot was produced by sudden and extreme drouth. It occurred on trees that were favourably located as well as on those that were growing under rather unfavourable soil conditions. Cork is apparently also a drouth effect, but it differs from drouthspot in the fact that its occurrence is usually associated with certain peculiar soil types.

3) Experiments have shown that there is a close relationship between

the soil-water supply of the orchard and the development of bitter-pit in storage. Heavy irrigation greatly increased the disease, but not so much as medium irrigation followed by heavy irrigation. Light irrigation greatly reduced it, but heavy irrigation followed by light resulted in the lowest percentage of the disease. Sudden changes in the amount of soil-water apparently did not increase the disease.

4) Heavy irrigation may have been slightly favourable to the development of Jonathan-spot, but the contrasts were too slight to justify definite conclusions.

5) Large apples showed greater susceptibility to bitter-pit than small ones, but with Jonathan apples heavy irrigation increased the disease on the medium-sized fruit as well as on the large, and with Grimes the percentage of increase from heavy irrigation was even greater on small apples than on large ones. Apparently, large apples are not susceptible to bitter-pit merely because they are large, but rather because of certain conditions under which they become large.

6) In 1915 there was more Jonathan-spot on the large apples than on the small ones, but in 1916 there seemed to be no correlation between size of fruit and severity of disease.

7) During the first weeks of cellar storage more Jonathan-spot developed on apples that were picked early than on apples that were picked late, but with longer periods of storage these contrasts seemed to largely disappear. The results indicate, however, a greater susceptibility in the early-picked fruit.

8) Bitter-pit was worse on the Jonathan apples that were picked early than on those that were picked late.

1049 — *The Injurious Action of Magnesium Carbonate on Plants.* — Sec No. 969 of this Review.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERAL

1050 — *The Morphology and Biology of **Blepharospora cambivora**, an Agent of the "Ink Disease" of the Chestnut* (1). — PETRI, L., in the *Annali del R. Istituto superiore forestale nazionale*, Vol. III, pp. 3-34 of the Reprint + 8 Figs + 1 Plate. Florence, 1918.

The mycelium that kills the cambium and which constitutes the specific agent (*Blepharospora cambivora* Petri) of the disease should be classed with the order *Saprolegniineae* of Schröter. It is characterised by an abundant development of multicellular hyphae on dead organic matter as well as by the formation of lemonshaped, isolated, terminal sporangia that produce zoospores or non-motile spores. The formation of spheroidal oospores with smooth walls takes place in the terminal oogonia fertilised by the filamentous antheridia.

The spores germinate in the water of the soil humus of the chestnut

(1) See R., March, 1918, No. 361 (*Ed.*)

[1048-1050]

wood or in that of streams into which the mycelium may be washed. In artificial culture the spores were germinated in drinking water or in very dilute solutions of nutritive mineral salts. Up to the present the formation of oospores has only been observed in the infected tissues of young, germinating plants. The presence of soluble carbohydrates and nitrogenous compounds hinders the formation of sporangia, while it favours the purely vegetative growth of the mycelium. The presence of calcium oxide not only inhibits the formation of spores, but also hinders the growth of the mycelium.

The dissemination of the parasite in the same chestnut wood or over a relatively limited area is chiefly due to rain water running over the ground and into the brooks.

The mycelium and the motile and non-motile spores cannot resist drying.

Dissemination by the wind only takes place in the case of the oospores. Chestnut woods should, therefore, be very closely watched, as it is chiefly from them that the durable germs of the parasite spread in large numbers and to a great distance. Infection does not take place through the direct attack of the germination tube of the spore, but always after the mycelium produced by a spore has developed saprophytically in contact with the receptive organ.

Artificial infection tests have shown that the parasite may attack germinating young plants as well as subjects of all ages, but only in the subterranean organs or in the basal portion of the stem. The great ease with which the disease was reproduced artificially shows that the effect of eventual conditions favouring receptivity can rightly be considered as negligible in the etiological study of the disease.

A damp and mild winter and spring constitute the principal conditions favouring the appearance of the disease, given that they are essential factors for the development of the parasite.

The parasitication of *Bleph. cambivora* can be considered as specific, as the fungus has been found to be unable to attack other Cupuliferae.

1051 — The Resistance of Manitoba Wheat to Fungous Diseases (1). — SCHRIEBAUX, in the *Comptes rendus des séances de l'Académie d'Agriculture de France*, Vol. IV, No. 17, pp. 530-532. Paris, 1918.

In the spring of 1917, "Manitoba" and "Aurore" wheats were sown at the Grignon School of Agriculture by the side of "Japhet", "Bon Fermier" and "Saumur de printemps" for the purpose of studying their comparative resistance to fungous diseases.

The results are interesting, showing the superiority as regards their resistance to smut of the alternative wheats (Japhet and Bon Fermier) over the spring wheats (Saumur de printemps and Aurore) which, before Manitoba was introduced, were usually grown at the School. Thus, for 3 smutted ears of Bon Fermier and 16 of Japhet, sown on March 16, 1917, there were no less than 74 for Saumur de printemps.

(1) See R., January 1918, No 34. (Ed.)

For the same wheat the number of smutted ears increases as the sowing date gets later. Thus Saumur de printemps, sown on March 16, gave 74 smutted ears and when sown in the same soil a month later, on April 14 gave 157 or more than double.

Manitoba is remarkably resistant to smut and to fungous diseases in general. In the experiments in question, not a single smutted ear was seen either in the plots sown early (March 16) or in those sown late (April 26).

The author concludes that Manitoba wheat will probably be of great value to plant breeders for the creation of new wheats resistant to fungous diseases.

MEANS  
OF PREVENTION  
AND CONTROL  
DISEASES  
OF VARIOUS  
CROPS

1052 — **Patents for the Control of Diseases and Pests of Plants.** — See No. 1030 of this Review.

1053 — **Cereal Mildew (*Sclerospora macrospora*) observed on Maize, in Piedmont (1), Italy.** — GABOTTO, L., in *Il Coltivatore*, Year LXIV, No. 16, pp. 331-333 + 3 Figs. Casale Monferrato, 1918.

In 1917, in a plot containing about 300 plants of maize, the author found about 60 plants attacked by *Sclerospora macrospora* Sacc. The diseased plants — with a weakly general appearance — had virescent male flowers and no ears.

The author advises that infected plants should be burnt to prevent the spread of the disease, and a watch kept for freshly diseased plants.

1054 — **Smuts Injurious to Sorghum in the Presidency of Bombay.** — KULKARNI, G. S. in the *Agricultural Research Institute, Pusa*, Bulletin No. 78, pp. 1-16 + 6 Plates, Calcutta 1918.

The word "Jowar", as used in the Bombay Presidency, indicates all the cultivated varieties of *Andropogon Sorghum* Brot. (= *Sorghum vulgare* Pers.), which takes the first place among cultivated crops in the Presidency. Jowar is so largely grown on account of its two-fold use as food and fodder.

The number of fungous diseases affecting this crop is large, but by far the most important of them from the economic point of view are those that cause the well-known smut disease. In the Bombay Presidency 4 smuts have been found attacking sorghum; these are:—

1) *Sphaelotheca Sorghi* (Link) Clinton, occurring throughout the Presidency; known as "grain smut";

2) *Sph. cruenta* (Külm) Pot., in the Sholapur district; known as "loose smut";

3) *Tolyposporium filiferum* Busse, in Sind; known as "long smut".

4) *Sorosporium Reilianum* (Külm) Mc Alpine, sporadically, throughout the Presidency; known as "whole-head smut".

The virulence and distribution of the disease seems to depend largely upon the freedom or otherwise from contamination of seed with spores previous to sowing. In general, localities with high rainfall have more smut

(1) See R., April 1917, No. 381; R., Sept. 1917, No. 872; R., April 1918, No. 477. (Ed.)



than those with low rainfall. It has also been found that the varieties of sorghum called Kharif (the monsoon crop, sown in June-July and harvested in October-November) are more attacked than those called Rabi (the winter crop, sown in September-October and harvested in February-March). However, loose smut (*Sph. cruenta*) is more common on the Rabi varieties in the Sholapur district.

The intensity of the damage caused by these smuts varies from year to year and even from field to field in the same locality. Thus the loss may be from 2 to 3 % for mild attacks up to 40 or 50 % for severe ones.

The deformation of the inflorescence resulting from the attack of each of the smuts is described as well as the characteristics and germination of the spores.

The author's observations confirm those of previous authors, which have shown that infection in the grain and loose smuts takes place at the seedling stage through the seed-borne spores.

As regards whole-head smut (*Sor. Reilianum*), the plant appears to be chiefly infected through the soil. In the long smut (*Tolyp. filiferum*) whose life-history is not known, it still remains to be ascertained whether infection takes place through the flower or through the spores in the soil from the previous crop.

The best preventive measure against *Sph. Sorghi* and *Sph. cruenta* is to treat the seed with copper sulphate solution, thus providing an easy, quick and cheap method. It was found that the seed can be dipped into a copper sulphate solution for 10 minutes, even at 3 % strength without in any way injuring their germinating power, and that even a  $\frac{1}{2}$  % solution acting for 10 minutes is successful in preventing the appearance of the two smuts in question.

No preventive measure against *Tolyp. filiferum* can be advised, as its complete life-history is not known.

The copper sulphate treatment is now widely advocated by the Bombay Agricultural Department and is practised by the cultivators. In order to meet the demands of the cultivators for copper sulphate, small packets of copper sulphate, worth an anna, have been prepared for some years. Each packet contains sufficient material for treating seed for 4 acres and includes instructions for use printed in all the vernaculars of the Presidency.

1055 - *Bacillus Solanacearum* Injurious to *Ricinus*, in U. S. A. (1). — SMITH, E. F. and GODFREY, G. H., in *Science*, New Series, Vol. XLVIII, No. 1228, pp. 42-43. Lancaster, Pa., July 12, 1918.

To the already considerable list of natural host plants of *Bacterium Solanacearum* (brown-rot of Solanaceæ) must now be added the castor oil plant (*Ricinus communis*), which has been seriously attacked by the fungus in various localities of Georgia and Florida.

The *Ricinus* plants wilt in various stages of growth, and often at an

(1) See R., August, 1912, No. 1238 and R., July, 1917, No. 680. (Ed.)

early one. Dwarfing is usually the first sign of the disease in the seedling plants.

By using a culture of the bacterium isolated from the castor oil plant the author was able to produce the disease in several plants known to be subject to *B. Solanacearum*.

Land on which any of the common Solanaceous plants have wilted should not be planted to *Ricinus*, unless it is known positively that the wilt was not of bacterial origin.

1056—**The Danger of Burying Felled Coconut Trees Between Rows of Rubber Trees in the Federated Malay States.**—SOOTH, F. W., in *The Agricultural Bulletin of the Federated Malay States*, Vol. VI, No. 6, p. 269. Kuala Lumpur, 1918.

Observations recently made on a large rubber estate have shown that the practice of burying felled coconut trees between rows of rubber trees, is very dangerous. The coconut trees, instead of being buried, must be split, dried and burned.

A part of the estate in question had originally been planted with coconuts. At a later date the coconuts were interplanted with rubber. About 3 or 4 years ago, the coconut trees were cut out and their trunks cut into lengths and buried in the middle of the spaces between the rows of rubber trees. In 1917 it was found that a large number of the rubber trees were dying or sickly. They were found to be suffering from root diseases, principally brown root disease, *Hymenochaete noxia*, and wet rot, *Poria hypolateritia*, either together or separately. In nearly every case it was found that a badly diseased and decaying root of each of the attacked trees ran back into one of the pits in which the coconuts had been buried. In some instances only the roots connecting with the pit had become diseased, and the disease had not reached the main root and collar. In such cases the infected roots were cut off and burnt, thus saving the trees. In other cases, however, the main root and collar were badly affected and the trees had to be taken out and burnt.

After this discovery all the pits were opened, and the decaying trunks were taken out, split up, dried and burnt. At the same time rubber roots in the pits were followed up and when diseased were removed and burnt. Indications of the presence of *Poria hypolateritia* were found on most of the decaying coconut trunks.

Heaps of dug-out coconut wood that had been drying for a few weeks also showed numerous fructifications of the fungus *Fomes lucidus*, a common saprophyte in the tropics that has been recorded as killing trees, which it attacks at the roots and collar.

It was evident that two of these fungi that were rotting the coconut trunks were *Hym. noxia* and *P. hypolateritia* and that these trunks were full of these fungi in an actively growing condition just about the time that the roots of the rubber trees had grown long enough to penetrate well into the mass of decaying material. It should be remembered that such decaying material contains moisture and that tree roots are definitely attracted by moisture.

1057 - **Diseases of Sugar-Cane in Tropical and Subtropical America, especially the West Indies.** — JOHNSTON, J. R. (in collaboration with ASHBY, S. F., BANCROFT, C. K., NOWELL, W., and STEVENSON, J. A.), in the *West Indian Bulletin*, Vol. XVI, No. 4, pp. 273-308 + 7 Plats. Bridgetown, 1918.

It has seemed desirable to publish, in brief form, and for the use of both investigators and planters, descriptions of common cane diseases and their causative fungi occurring in tropical and subtropical America.

The bulk of the data given in the paper was compiled by Mr. JOHNSTON when working on the subject during a residence of four years in Porto Rico, several years in Cuba and during studies in Santo Domingo and in the Southern United States, besides various visits to many parts of tropical America.

As it was considered specially desirable to make the records as complete, the cooperation of the following phytopathologists in the American Tropics was asked:— ASHBY (Jamaica), BANCROFT (British Guiana), NOWELL (West Indies), and STEVENSON (Porto Rico).

The description of the diseases is followed by notes on their prevention and cure (a whole chapter is devoted to the control of fungous diseases) and a long bibliography on the subject.

The following diseases are specially considered:—

- 1) *Bacterium vascularum* (gumming disease of sugar cane);
- 2) Humid gangrene or "Polvillo" a disease probably due to the above-mentioned bacterium;
- 3) *Trichosphaeria Sacchari*;
- 4) *Gnomonia Iliou* (stem rot or Iliou);
- 5) *Sphaerella Sacchari*;
- 6) *Eriosphaeria Sacchari* (red leaf spot);
- 7) *Leptosphaeria Sacchari*;
- 8) *Thyridaria tarda*;
- 9) *Nectria Laurentiana*;
- 10) *Ustilago Sacchari* (smut);
- 11) *Hypochnus Sacchari* (thread blight);
- 12) *Odontra saccharicola*;
- 13) *O. Sacchari*;
- 14) *Marasmius Sacchari* (root disease);
- 15) *M. stenophyllus* (root disease);
- 16) *Schizophyllum alneum*;
- 17) *Laternea columnata*;
- 18) *Cytospora Sacchari*;
- 19) *Coniothyrium melasporium* and *Darluka melaspora* = *Melanconium Sacchari* (rind fungus);
- 20) *Diplodia cacaoicola*;
- 21) *Colletotrichum falcatum*;
- 22) *Melanconium saccharinum*;
- 23) *Cephalosporium Sacchari* (wilt);
- 24) *Thielaviopsis paradoxa* (pine-apple disease);
- 25) *Cercospora longipes* (brown leaf-spot);

- 26) *C. vaginæ* (red spot of leaf sheath);
- 27) *C. Kopkei* (yellow leaf-spot);
- 28) *Helminthosporium Sacchari* (eye leaf-spot);
- 29) *Sclerotium Rolfsii* (red rot of leaf-sheath);
- 30) *Himantia stellifera*;
- 31) Yellow stripe disease;
- 32) Top rot;
- 33) Sereh;
- 34) Mottling disease;
- 35) Wither-tip;
- 36) Chlorosis.

1058 — *Cercospora solanicola* and *Cercospora* sp., Fungi respectively injurious to Tobacco and Sesame in the State of Pernambuco, Brazil. — AVERNA, S. R., in *Secretaria da Agricultura, Commercio e Obras Publicas do Estado de Sao Paulo, Boletim de Agricultura*, Series XIX, No. 1, pp. 70-71. Sao-Paulo, 1918.

Tobacco leaves from the School of Agriculture of Soccorro (Pernambuco) were found to be attacked by *Cercospora solanicola* Atk., a parasite already recorded in the State of Sao-Paulo, in 1913 and 1914 on some plants of *Nicotiana Tabacum*.

The disease is very serious as the numerous spots on the leaves render them almost worthless. The parasite usually attacks plants growing in damp, shady places. The various species and varieties of tobacco show varying degrees of resistance to the disease.

As anticyptogamic remedies, though efficacious, would sensibly affect the commercial value of the leaves, the author advises growers to limit themselves to the following measures:—

- 1) the choice of resistant species and varieties;
- 2) if the ground is too damp, it should be drained or used to grow other crops;
- 3) avoid planting too close so as to allow the free passage of air round the plants;
- 4) at the first sign of infection, all diseased leaves should be cut and burnt.

On the leaves of "gergelim" or sesame (*Sesamum indicum*), also from Soccorro, were found spots, which, from the microscopical examination were attributed to a *Cercospora*. The plants should be carefully watched and it is advisable, on the first signs of the disease, to uproot and burn the infected plants at once.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### MEANS OF PREVENTION AND CONTROL

1059 — *Aphelinus boveili* n. sp. and *Metalaptus torquatus*, Hymenoptera Parasitic on other Insects. — MALENOTTI, E., in "*Redia*", Pt. 1 and 2, pp. 77-92 + 17 Figs. Florence, 1918.

With the discovery of *Aphelinus boveili* n. sp., 8 Chalcidids are now known as parasites of the scale insect *Chrysomphalus dictyospermi* Morg (1).

(1) See R., January, 1918, No. 118; R., July, 1918, No. 828. (Ed.)

The author examined 5 females from Bridgetown (Barbadoes), sent by Prof. J. R. BOVELL, to whom the present species is dedicated.

A description is also given of another chalcid, *Metalaptus torquatus*, Malen., which had already been mentioned in a previous note (1917). The description is based on: — 10 specimens hatched out on orange leaves placed under a bell-jar for the purpose of studying the parasites of *Chrys. dictyospermi*; 3 females and 1 male in material from Mandarano (province of Catania); and 2 females in material from Palermo. The author thinks, however, that this species is not a parasite of *Chrysomphalus*, as certain Psocidae and some very minute lepidopterous larvae were present of which, as with other species of *Mymaridae*, *Metaloptus torquatus* might prove to be a true parasite.

1906 — *Casca luzonica* n. sp., a Hymenopteron Endophagous on the Scale-Insect *Schizaspis lobata*, in the Philippines. — MALENOTTI, E., in "Redia", Vol. XIII, Pt. 1 and 2, pp. 73-76 + 6 Figs. Florence, 1918.

A description of the chalcidid fly *Casca luzonica* n. sp., an endophagous parasite of *Schizaspis lobata* Cockerell and Robinson, based on 2 females found by the author in specimens of that scale-insect on leaves of *Ficus nota*, sent to the Royal Station of Agricultural Entomology at Florence by Prof. C. F. BAKER, of Los Baños (Luçon Isle, Philippines). The male of the new hymenopteron is as yet unknown.

Although the hymenopteron had not pierced a great number of scales, yet appreciable damage was done.

1901 — The Use of Bats in the Control of Insects especially Tortricidae, Injurious to Pine Woods (1). — JOLYET, A., in the *Revue des Eaux et Forêts*, Year XVI, Vol. LVI, No. 6, pp. 121-216. Paris, June 1, 1918.

On account of the damage suffered by French forests on account of the war, the author considers the possibility of invasions of injurious insects. Among those attacking pine woods, he fears *Evotria* (*Retinia*) *resinella*, *E. bouliana* Schiff. (pine-shoot tortrix moth) and *E. turionana* Hb. (pine-bud tortrix) the most. As bats destroy great numbers of these insects, the author proposes to breed these most useful Chiroptera or, rather, to encourage them to come to live near pine woods requiring protection. To do this it is sufficient to erect cots in the midst of the pine wood to serve as refuge during the day and where the bats can winter without suffering from the severe cold.

The author has devised a cot consisting of a wooden box with double walls (leaving an air space of about 1 in.) of cubical form with sides 3 ft. 3 in. long. The box is protected from the rain by a double roof of planks covered with tarred paper and projecting beyond the sides.

The space thus left between the box and the roof should be filled with hay to keep out the cold. On the side of the box facing east an opening 12 in. high and 8 in. broad should be cut. A slide moving up and down grooves will serve to shut or open the door, through which the bats will enter

(1) For the use of bats for the destruction of mosquitoes, see R., August 1913, No. 903. (Ed.).

or leave the shelter. The slide should be so arranged that it can be opened and closed by pulling a string, as the box should be placed about 10 ft high on a wooden scaffold or on a small tower built of stones without mortar. Inside the box rods will serve as perches for the bats.

The author advises the choice of bats belonging to the family Vespertilionidae (gen. *Vesperugo*) which hibernate in barns, towers, hollow trees, rather than bats belonging to the genera *Rhinolophus*, *Synotis*, *Plecotus*, *Vespertilio*, which are sensitive to cold and hibernate and caves and underground places. The first mentioned stand the cold better, are hardier, and live more peaceably with other bats than the latter, and also take to the cots more easily. In the genus *Vesperugo*, the large *V. noctula* and *V. serotinus* are of special interest. These attain a length (without the tail) of 3.1 and 2.7 in. respectively, the spread of the wings being 14.1 and even 16.5 in. for the first and 12.9 in. for the second. *V. noctula*, so common, is particularly suitable on account of its size, its rapid, high flight and because it leaves its hiding place at night fall. The author also remarks upon *V. pipistrellus* (1.1 in. long; spread of wings 3.1 in.), a small species, but the commonest and easiest to adapt to a state of semi-domestication.

INSECTS, ETC.,  
INJURIOUS  
TO VARIOUS  
CROPS

1062 - The Alfalfa Looper (*Autographa californica*), Injurious to Various Cultivated Plants in Canada. — GIBSON, A., in *The Agricultural Gazette of Canada*, Vol. V, No. 2, pp. 132-136 + 2 Figs. Ottawa, February, 1918.

*Autographa californica* (the alfalfa looper) is widely distributed in western North America. In Canada it occurs in the provinces of British Columbia, Yukon, Alberta and Manitoba. Although there are no actual records of its presence in Saskatchewan, it undoubtedly occurs, also, in that province. In the United States it occurs in the states of California, Nevada, Colorado, Oregon, Wyoming, Washington, Idaho, Utah and Montana. It has also been collected in Alaska and it appears to be present in New York state. It has been known in the United States as a pest of economic importance since 1895. In Canada, however, it only become sufficiently numerous to cause serious injury to crops in 1914. During that year, the damage caused was confined to the province of British Columbia. A large number of crops — alfalfa, lettuce, clover, beans, apple trees (leaves and fruits), clover, turnips, cabbage, garden, peas, potatoes, rhododendrons, laurel, rose, holly, etc. — were attacked.

In the United States the insect has been found feeding on malva, barley, elder, dock, sweet clover, wild lettuce, flax, sugar-beet, maize, carrots, cucumbers, muskmelons, watermelons, squash, currants, gooseberries, raspberries, lamb's-quarters and sunflower.

In 1903, at Ottawa, the author reared an adult moth found feeding on lupin at Mt. Arrowsmith, Vancouver Island, B. C.

In 1914, natural enemies of the alfalfa looper were present in British Columbia to a marked extent. These natural checks were very widespread and efficient. From material received at Ottawa from various localities the following natural enemies were reared: — *Plagia americana* Van der

Wulp, a tachinid fly already known as a parasite of *A. californica*; *Exorista futilis* O. S., a new tachinid fly parasite of the moth; *Microplitis alaskensis* Ashm., a hymenopteron known as a parasite of the moth in the United States; the tachinid fly *Phorocera saundersii*; and the hymenoptera *Sargagitis wehsteri* Vier., *Rhogas autographae* Vier., *Microplitis* sp., *Amelotenus* sp., *Apanteles hyslopi* Vier.

In addition to these natural enemies, birds were observed to feed readily upon the larvae, which, in some localities, were also attacked by a bacterial disease.

Since 1914, there are no records, thanks to its natural enemies, of the insect occurring in destructive numbers.

Paris green or arsenate of lead will destroy the caterpillars if used strong enough, but when they are present in such enormous numbers, spraying with an arsenical mixture is a rather hopeless task. A mechanical means of protection would probably be advantageous, such as digging trenches across the line of march of the caterpillars.

The insect and its life-history are fully described

1063 — **The West Indian Mole Cricket (*Scapteriscus vicinus*), Injurious to Crops in Porto Rico.** — VAN ZWALUWENBURG, R. H., in the *Porto Rico Agricultural Experiment Station, Mayaguez, P. R., Bulletin*, No. 23, pp. 3-28 + 3 Plates + Bibliography. Washington, 1918.

The most serious insect pest of general agriculture in Porto Rico is the West Indian mole cricket (*Scapteriscus vicinus* Scudder) known locally as the "changa".

In economic literature this insect has always been treated under the specific name of *didactylus* (1) a name now given to a closely related species. *S. vicinus* is a native of South America and the West-Indies, but it does most damage in Porto Rico.

The changa feeds primarily on vegetables, animal food seeming to form only a small part of its diet. Almost any young plant growth is attacked. The insect remains underground and feeds from below, commonly selecting the crown of the plant as the point of attack. *S. vicinus* attacks tobacco, tomato, egg-plant, potato, pepper, sugar cane, grama grass (*Paspalum* sp.), yerba dulce (*Eleusine indica*), Bermuda grass (*Cynodon dactylon*), rice, cabbage, collard, rape, turnip, cantaloup, sweet potato, lettuce, *Coleus* spp. and *Livingstonea* spp. The insect also causes much damage by trimming roots that lie along its path.

The author describes the adult and deals with its life history. The life cycle covers about one year. About three weeks are required for the egg stage; about nine months for development from hatching to the adult stage; and over two months for the pre-oviposition period.

Although the changa has many natural enemies particularly among the native birds, it is not held in check by them. With the exception of a nematode, no parasitic enemies of the insect are known to occur in Porto Rico.

(1) See R., January 1916, No. 129 (Ed.)

During the autumn months the changa flies in large numbers on damp, overcast evenings. The greater proportion of changas attracted to lighted areas are females. Flooding is of value when water is easily available.

Napthaline and sulphur are the only repellants found to be of any value, and even they are only partially effective.

Sugar cane is protected from the changa by planting it in a perpendicular or slanting position. Hilling up plants greatly reduces changa injury in gardens.

The use of poison baits, together with clean cultivation of the area to be planted, is recommended. A dry mixture of 3 % Paris green with cheap flour is particularly acceptable to the changa.

1064 - *Trioza alacris*, a Hemipteron Injurious to Laurel in New Jersey, U. S. A.

— WEISS, H. B. and DICKERSON, R. T., in *Psyche*, Vol. XXV, N. 3, pp. 59-63. Boston, June, 1918.

*Trioza alacris* Flor (syn. *T. lauri* Targ.), which was introduced into New Jersey from Belgium and which is well known and destructive in Europe, had already been recorded by WEISS in 1917 as occurring in New Jersey.

This Psyllid occurs in New Jersey on bay trees which are kept either under glass all the year or out of doors during the summer. Its presence on the bay (*Laurus nobilis*) can be readily detected by the curled, discoloured, swollen, blistered leaves, usually at the tips of the branches, containing what appear to be whitish masses. Observations on the biology of the parasite were made on trees kept outside during the summer months. The author describes the eggs and then the five stages of the nymph, using alcoholic material. The description of the adult is quoted from CRAWFORD.

While contact insecticides are useful, it is impossible to reach the nymphs in the curled leaves. In New Jersey almost complete killing was secured in one case by fumigating with tobacco smoke as for aphids while the trees were in storage and heavily infested by over-wintering adults. Hydrocyanic acid gas has been used with success.

It is the practice of some firms to pick off all curled infested leaves, but this is a slow process in a large establishment.

1065 - *Papilio thoantiades*, a Macrolepidopteron Injurious to Citrus and the Hymenopteron *Pteromalus caridei*, its Natural Enemy, in the Argentine. —

CARIDE MASSINI, P. and BRÈTHES, J., in the *Anales de la Sociedad Rural Argentina*, Year, LIII, Vol. LII, No. 2, pp. 73-76 + 2 Coloured Plates. Buenos Ayres, 1918.

In Florida the macrolepidopteron *Papilio thoantiades* Burm. ("isoca de los naranjos") is one of the most dangerous pests of citrus plants (orange, lemon, etc.) whose leaves the pest attacks when in the larval state. Fortunately, the chalcidid *Pteromalus caridei* Brèthes, first described in 1913, attacks the pest, laying its eggs in the chrysalis of the lepidopteron. The chalcid also sometimes attacks the macrolepidopteron, which is its only host, in the larval stage.



From each chrysalis of *Papilio* emerge 80 to 100 individuals of *Pteromalus*. In one case 98 % of the chrysalids were attacked.

The hymenopterous can be easily transported and used in the control of *P. thoantiades*; in consequence the chalcid should be bred and protected in citrus-growing regions.

A detailed description of *P. thoantiades* and *P. caridei* is given.

1066 - A Tortricid Moth Injurious to the Chestnut Tree, in Italy.— DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, First Half Year, No. 1, pp. 21-30 + 3 Figs, Florence, 1918.

In the chestnut woods on the Apennines between Emilia and Tuscany, after August has begun, one may see the soil covered to varying degrees, according to the year and the position, with very young chestnuts, still green or partly yellowed. On these chestnuts, hidden by a mass of excreta, is a round hole which is the opening of a tunnel leading into the cavity occupied by the growing achenes (chestnuts).

Inside these husks or in the chestnuts themselves, there are nearly always one or two larvae of different ages, which, according to the author, are the larval stage of a tortricid moth, probably *Carpocapsa splendana*.

According to the inhabitants of the region, the nuts begin to fall in September without, however, affecting the injurious action of the larvae. The presence of the larvae causes the nuts to open prematurely in the second half of September or even at the fall of the first chestnuts.

In October and the beginning of November, the chestnuts are more and more attacked by the larvae and when the drying of the chestnuts by fire is begun in the first half of November (in the high Modenese and Bolognese Apennine), a great number of larvae leave the chestnuts after 24-36 hours exposure to the heat.

Once the chestnuts are dried and freed from the pericarp, the worm-eaten nuts should be separated from the sound ones before grinding them to obtain the flour used for making "pattona" or "castagnaccio". These foods have often, however, a bitter, unpleasant taste. This is due to the fact that the farmer or proprietor does not separate the sound from the worm-eaten chestnuts in order to have a greater quantity of flour to sell. As a result of this the excreta and larval skins impart the bad qualities of the flour from diseased chestnuts to that from sound chestnuts. Such flour, unfit for human consumption, might be given to live stock, but sparingly, as it might cause various disorders if given in quantity. Moreover, chestnuts eaten by the larvae are not relished by live stock.

To restrain the ravages, the nuts that fall to the ground in August should either be collected and burnt, or buried deeply; they may also be thrown in the pits full of stagnant water which, in the Apennine districts, serve as a manure heap. The first chestnuts to fall must on no account be left lying on the ground and those that fall normally should be collected as soon as possible. When the chestnuts are dried, precautions should be taken that the larvae do not escape and seek shelter when, under the action of heat, they leave the chestnuts.

1067 - *Stictolobus trilineatus* n. sp., a Hemipteron (Homoptera) living on Cypress, in Louisiana, U. S. A. — FUNKHOUSER, W. D., in *Entomological News*, Vol. XXIX, No. 5, pp. 185-187 + 1 Plate. Philadelphia, 1918

The author gives the description of the Membracid *Stictolobus trilineatus* n. sp., found in comparative abundance on cypress at Bogaloussa' on June 15, 1917 and on the next day at Colyell, also on cypress.

This insect is the first membracid found on cypress and the second representative of the genus *Stictolobus* founded by METCALF in 1916 to accomodate *Membracis subulata* Say (= *Stict. subulatus* Say).

[1067]

INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

## INTERNATIONAL REVIEW OF THE SCIENCE AND PRACTICE OF AGRICULTURE

MONTHLY BULLETIN  
OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

FIRST PART.  
ORIGINAL ARTICLES

### Mechanical Ploughing.

#### Methods for Ploughing in Ridges.

by  
A. TARCHETTI

*Engineer in Charge of the Mechanical Department of the "R. Stazione Sperimentale  
di Riscoltura" of Vercelli, Italy.*

#### PLOUGHING IN RIDGES.

This is the most usual method of ploughing in Italian soils, especially for irrigated crops, and it is also that most suited to the great majority of motor- or tractor-ploughs imported from the United States, that is, ploughs turning the soil to one side only (with a single mould-board, right- or left-handed).

This system may be used with balance, turn-wrest and double-brabant ploughs when the open furrows separating the ridges are narrow and shallow. In this case, provided care is taken that the plough wheels do not fall into the open furrow, the ordinary method of ploughing without ridges (1) may be carried out, neglecting the open furrows (especially if a gang plough or, better still, cable traction is used), which will only be partially filled up, thus leaving a depression which will serve as a guide when the open furrow is reopened or put right with an ordinary plough.

(1) See Fig. 1, of the second article, *Methods of ploughing without ridges*, in *R.*, Sept., 1918, p. 1018.

But when the open furrows are large and deep and when the ground must be maintained perfectly level — as is the rule for the rice fields of upper Italy — ploughing without ridges does not allow of good work and, to preserve the ridges, it is necessary to resort to gathering up and casting.

• It should first be noted that, in ploughing without ridges, the drainage-furrows are left at the same place each year whilst with the second method (gathering-up and casting) the open furrows are displaced each time the

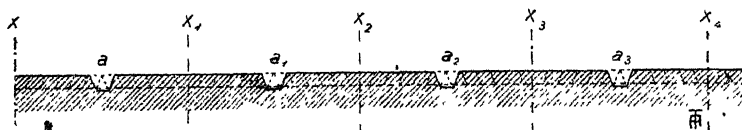


Fig. 1. — Displacement of the open furrows each time the ground is ploughed.

ground is ploughed : the furrows  $a, a_1, a_2, \dots$  (Fig. 1) are filled up on gathering-up and, on casting, an equal number of new open furrows corresponding to the median axes  $x, x_1, x_2, \dots$  of the ridges are opened, at the place where the summit of the ridges was previously. This fact, as will be seen later, has considerable influence on the method to be followed in ploughing.

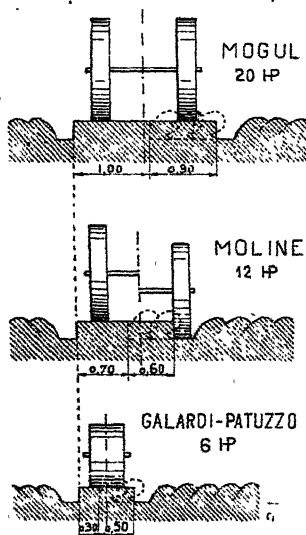


Fig. 2. — The strip left unploughed by various machines.

Ploughing in ridges can also be carried out with balance, turn-wrest and double-brabant ploughs. In this case the half-ridge  $ax$  is ploughed, after which, leaving the half-ridge  $ax_1$ , the half-ridge  $a, x_1$  is ploughed, and so on, so as to plough all the half-ridges to the left of the open furrows. When the last but one half-ridge —  $a_{n-1}, x_{n-1}$  — is ploughed, the ploughs are *turned*, so that those that turned the soil to the right in going now turn to the left on the return, or viceversa, *i. e.*, the last half-ridge  $a_{n-1}, x_{n-1}$  is ploughed, then  $a_{n-2}, x_{n-2}$ , etc., up to the second,  $ax_2$ , which completes the work. But this method leads to loss of time and awkward turns (with cable anchorages, it is practically impossible), so that ploughing in ridges is reserved for machines with ploughs having but a single mould-board.

Before examining the method of procedure in each case it will be advisable to recall certain considerations.

In our (Italian) soils it is almost impossible to complete the mechanical ploughing of the ridges. Above all, the machines, especially with gang

ploughs, are unsuitable for opening the first furrows along the open furrow and, to make sure of the regularity of the following ploughing, it is always advisable to carry out the work first gathering-up the open furrows to the left and right with an ordinary plough. Again, the ordinary machines cannot finish the ploughing, or as the farmer says, cannot close it. In fact, if the three commonest types of machines in Italy (Fig. 2) are considered, it will be seen that each of them has to leave unploughed a more or less wide strip (12 to 39 in. and more) in every ridge, unless the wheels pass over the ground already ploughed, which would be detrimental. On the other hand it is very difficult to finish such a narrow strip, for the resistance of the soil is not equal for all the ploughs, so that they would slip sideways. On the contrary, with the stilt plough it is easier to correct the unavoidable irregularities of the strip and to open, exactly in the middle of the ridge, a straight furrow of uniform width.

In order that this strip may be ploughed as well, it is necessary that the machine should haul a gang of such a width that the total width ploughed is equal to or even greater than the distance between the driving wheels, which would give the mechanical advantage of displacing the centre of resistance towards the centre of power; but in our (Italian) soils, and in the case of direct haulage, the difficulties of gripping the soil are in opposition to this.

Thus, it should be reckoned that, for each ridge (Fig. 3), independently of its width  $L$ , a total width of from 39 to 63 in. cannot be ploughed mechanically in practice, so that with ridges only 10 to 13 ft. wide for example, about half the field would have to be ploughed with teams. As a result the width of  $L$  should be kept as large as possible, which gives the driver the extra advantage of avoiding too narrow turns and of enabling him to obtain, with the more continuous and uniform handling, more regular ploughing. It is hardly necessary to add that the width of the ridges should be such that the width  $A$  is a multiple of the width of the gang.

On the other hand, however, there are two considerations in opposition to the excessive increase of the width of the ridges; these are as follows:—

1) *The total journey with the ploughs lifted on the headlands at the head of the ridges is not proportional to the width of these latter, but, as Prof. RINGELMANN has justly remarked (1), increase in an arithmetical progression. In fact, let us take a machine ploughing a strip 47 in wide, and let us suppose for the sake of simplicity that the axis of the machine (generally the centre of power) coincides with the centre of that strip (that is, with the centre of resistance of the gang) and that the machine can*

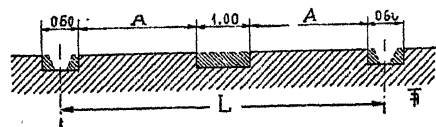


Fig. 3. — Plan of ground to be ploughed with a team.

(1) See the *Journal d'Agriculture pratique*, 1917, p. 436.

"close" the ploughing completely. Let us consider what takes place on one-half of the headland at the head of the ridge: — as that is repeated on the other half of the same headland and on the two halves of the opposite headland, there will be 4 equal operations for each headland. If the ridge is, for example, 23 ft. 6 in. wide, or 11 ft. 9 in. for each half (Fig. 4), the machine will plough the half-ridge in 3 journeys, that is, in order to arrive at the first furrow (gathering-up) it would have to move a distance of

Fig. 4. — Ploughing a half-ridge, 11 ft. 9 in. wide, in 3 turns.

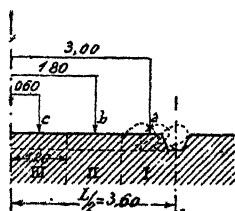
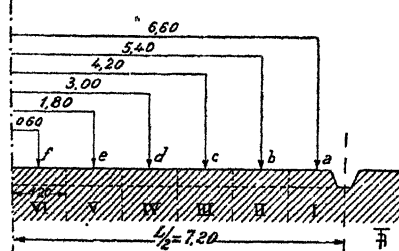


Fig. 5. — Ploughing a half-ridge, 23 ft. 6 in. wide, in 6 turns.



10 ft. on the chief headland, and then turn at right angles so as to begin the first furrow at *a*. When it returns on the same headland to begin the second furrow, it will have to move 5 ft. 11 in., and, finally, for the third furrow 2 ft. In the 3 journeys it has thus moved a distance of 17 ft. 8 in. on the edge of the field.

If the ridge is double-width ( $L = 47$  ft. 3 in.;  $L/2 = 23$  ft. 7 in.) the machine will plough the half-ridge in 6 journeys, but the various journeys (Fig. 5) will be respectively 20 ft. 10 in., 18 ft. 2 in., 13 ft. 9 in. . . . and the total distance travelled will be 70 ft. 10 in., that is to say not double, but *four* times the previous one.

The total distance travelled with the ploughs lifted along a half-headland is thus equal to the product of the average journey ( $L/4$ ) and the number of journeys, or, speaking algebraically, to the sum of the terms of an arithmetical progression whose first term is half the width of the strip ploughed (or of the gang), whilst the ratio or difference is that of the width itself (1).

(1) Prof. RINGELMANN considers the width of the gang or strip ploughed as the first term of the progression, and thus obtains, in his calculations, figures that are rather too high; on the contrary, however, we, on the assumption that the axis of the machine coincides with that of the gang, have obtained figures that are rather too low, but which we consider are nearer to practical conditions.

The result is that the time lost and fuel consumed on the journeys with the ploughs lifted are the greater as the ridge is wider, and it is with reason that Prof. RINGELMANN proposes a width of 98 feet (in practice not more than 66 ft.) as a maximum, also with the idea of avoiding excessive injury to the headlands by repeated passage of the machine.

2) The width of the ridges nearly always depends on the nature of the ground or crop, as well as on the form of the field (1).

On account of this necessity for width of the ridges, the ploughing has nearly always to be carried out in a special way, which is also necessary and *quite distinct for each case*.

If one uses a machine with a central gripping drum (GALARDI-PATUZZO type motorploughs) which can pivot on the drum itself, the width of the ridge has no influence, and the work can be carried out as with the ordinary stilt plough. In fact, in the case of a ridge limited by the open furrows

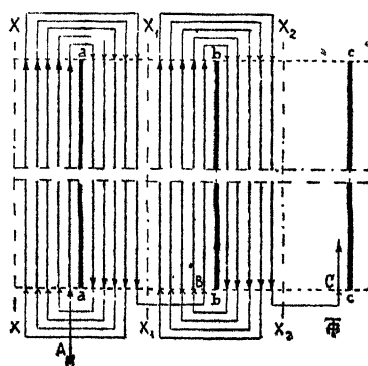


Fig. 6. Gathering-up a ridge.

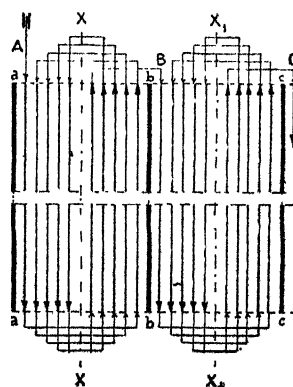


Fig. 7. — Casting a ridge.

*aa bb* (Fig. 6) the work is begun at *A* in the direction of the arrow by gathering up the last furrow to the right, then passing to the other side of the last furrow, always gathering up to the right (if the plough throws to the right) and continuing in this way until, having arrived near the middle

(1) In the rice fields of the Vercelli region, ridges not more than 22 to 26 ft. wide are usually adopted so as to facilitate levelling and drying the ground and also as to *a*) be able to broadcast the seed in one journey; *b*) lose no time at the moment of scarifying in order to move the bunches of weeds gradually up to the longitudinal open-furrows; *c*) help in loading and carting the sheaves by allowing one of the cart wheels to run on the firmer bottom of the open furrows. In the rice fields of the Lomellina district, the ridges are still narrower, sometimes being less than 13 ft.; in such cases no attempt should be made to plough in ridges with machines with 2 driving wheels.

**XX** (where the strip to be finished with a team is shown wider), the machine passes at *B* to the last furrow *bb*, where the operation is repeated (1).

The ploughing may also be carried out as shown in Fig. 7, *i. e.*, casting instead of gathering up.

But if the machine, as often happens, is a tractor plough or a gang motorplough, which has to turn in a semi-circle with a well defined minimum radius (generally of 20 to 26 ft.), in this case and *according to the width of the ridges, the method to be followed must be decided upon clearly beforehand*, so that the work may be finished without requiring useless double turns and journeys with the ploughs lifted.

We add a few solutions of the commonest cases where, for the sake of simplicity, a series of only 3 gangs or furrow-slices are represented for each zone where the manœuvre is repeated.

Admitting that a strip equal to a half or whole ridge should be left in the field at the edge of the first and last furrows to enable the machine to pass to finish the headlands (2), the internal limit of that strip may be assumed to be the edge of the field; this is why the beginning and end of the ploughing, as has been already said previously, coincides in the following figures, now with an open furrow (solution A), now with the centre of the ridge (solution B).

In all the examples the ploughs are understood to turn the soil to the right, which is usually the case.

Case I. — *Ridges wider than 82 feet* (at least 2 are necessary). — It will be convenient to consider the ridge as divided into 4 zones or parts, each of which corresponds to a fresh manœuvre.

*Solution A* (Fig. 8). — Ploughing is begun at *A* by gathering up the open furrow *AB*; at *B*, the end of the furrow, the gang is lifted, and the machine turns to the left, and, at *D*, begins gathering up the second open furrow, up to *C*. There the gang is again lifted, the machine turns, always to the left, and the ploughs are earthed to the right of the first open furrow, and so on, going in the direction of the arrows, passing in turn from zone I to zone II, from zone II to zone III, from III to IV, etc., until, having turned the furrow of zone VIII nearest to the axis *xy* of the first ridge, the machine passes to the third ridge and begins ploughing the third and fourth ridges at *E*, as has been done for the first two turns. On the sides of the median axes *xy*, *x*, *y*, . . . the usual strip some 31 to 59 in. wide will remain to be ploughed with a team.

The narrowest turn (from 16 to 23 ft.) is only made in the first passage from zone VI to zone VII and corresponds to about  $\frac{1}{4}$  the width of the ridge.

(1) In this and the following figures, the journeys normal to the furrow slices are spaced for the sake of clearness, but it is obvious that in the field they are superimposed, the machine always travelling on the same line on the chief headland.

(2) See Fig. 1 of the second article, *Methods of ploughing without ridges*, in *R.*, September, 1918, p. 1018.



*Solution B* (Fig. 9). — Beginning at *B*, end near the axis  $X_2 Y_2$ . Two minimum turns — in the first passage from zone II to zone III and from zone VI to zone VII.

When the ridges are wider than 82 ft., the ploughing can be carried out in different ways; thus, for example, Figs. 10 and 11 show two variants,

*CASE I: Ridges wider than 82 feet.*

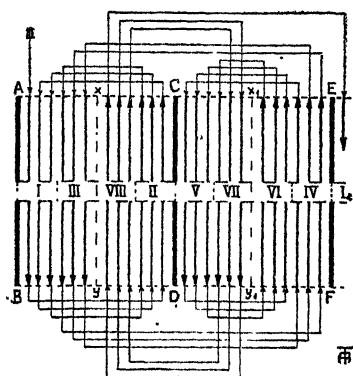


Fig. 8. — Solution A.

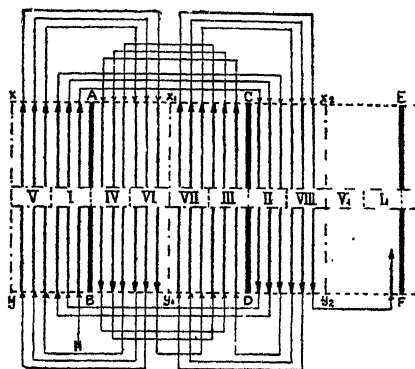


Fig. 9. — Solution B.

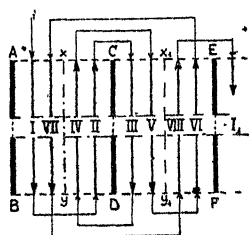


Fig. 10.

Variants of Solution A.

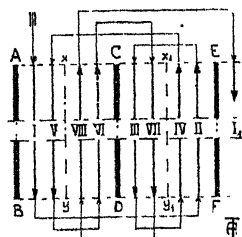


Fig. 11.

limited, for brevity, to solution A and showing only one furrow per zone. In both cases, the total journey with the ploughs lifted on the headlands is slighter more than in the case of Fig. 8; however, in the variant shown in Fig. 11, the minimum turns include half a ridge, that is, they can be carried out in the space of about 40 ft.

*Case II. — Ridges from 49 to 82 feet wide* (at least 3 are necessary). — In this and the following cases, the work is divided into two sections per ridge, that is, at the middle of the last furrow and vice-versa.

*Solution A* (Fig. 12). — There are 2 minimum turns (of 11 to 23 ft.) corresponding to about half the width of the ridge in the first passage from zone II to zone III and from zone IV to zone V.

Figure 13 represents a variant, drawn schematically like the previous ones and limited to solution A.

*Solution B* (Fig. 14). — Here also there are 2 minimum turns in the passage from zones II to III and IV to V.

As is shown in Fig. 14 the zones follow in the same order as in solution

*CASE II: Ridges from 40 to 82 feet wide.*

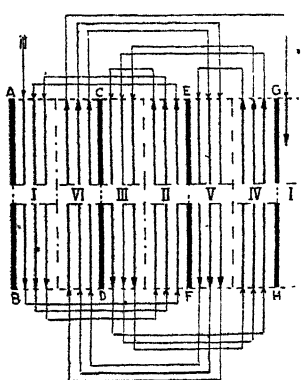


Fig. 12. — Solution A.

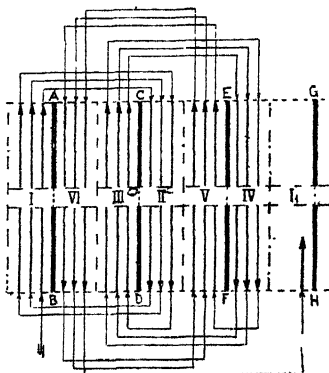


Fig. 14. — Solution B.

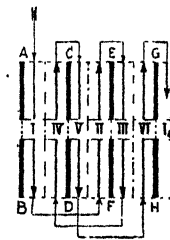


Fig. 13. — Variant of Solution A.

*A* (Fig. 12). This is why, in the following cases we have suppressed the graphic representation of solution B for the sake of brevity and we only indicate, by the dotted arrow, the beginning of ploughing.

*CASE III; Ridges from 20 to 49 feet wide.*

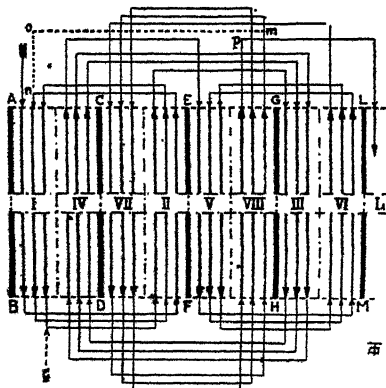


Fig. 15. — Solution A.

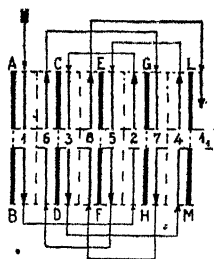


Fig. 16. — Variant of Solution A.

*Case III. — Ridges from 20 to 49 ft. wide (at least 4 are necessary). — Solution A* (Fig. 15). The minimum turns correspond to the width of a ridge; consequently, instead of first ploughing zones I and II completely,

then zones III and IV, etc., as is shown in Fig. 15, the machine can pass immediately, when each furrow is finished, from one ridge to another and finish the *cycle* of the 4 ridges furrow by furrow instead of zone by zone. Thus, after the first furrow to the right of *AB* and the second to the left of *FE* are opened, when the machine is at *E*, instead of returning to zone I, it moves to zone III, to the right of *GH*, then from *H* to zone IV, to the left of *DC*, and so on until the cycle to the right of *HG* is finished. When at *G*, the machine returns to zone I (as shown by the dotted line *mon*) and begins the second cycle at *n* and so on until the work is finished at *p* and the machine passes to the 4 following ridges. In Fig. 16 a variant of the usual procedure is shown.

CASE IV: *Ridges less than 19 ft. 6 in. wide.*

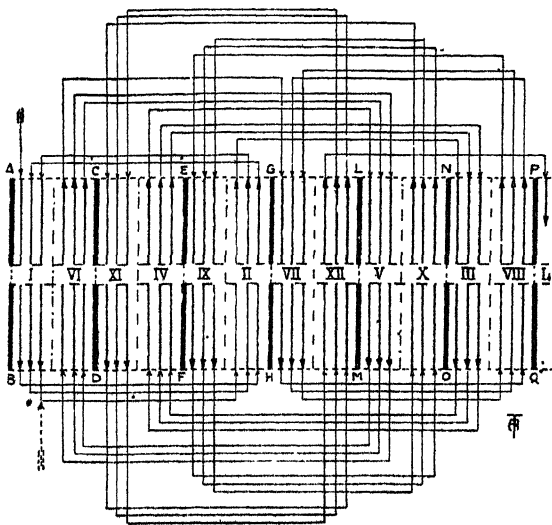


Fig. 17. — Solution A.

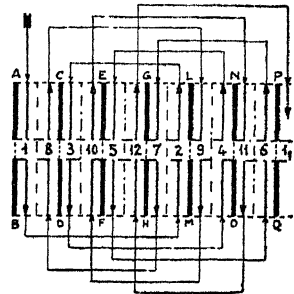


Fig. 18. — Variant of Solution A.

Case IV. — *Ridges less than 19 ft. 6 in. wide* (at least 6 are necessary). The same lettering is employed as in the previous case, but here the minimum turn includes the width of about 2 ridges.

*Solution A.* (Fig. 17) with a variant (Fig. 18).

With all the preceding solutions the field can be *completely* ploughed, provided (independently, of course, of the side and top headlands) that the field is divided into such a number of ridges as to form a multiple of the minimum number possible to complete each *cycle* of operations. Thus, in Case I, the ridges should be even numbers; in Case II, 3, 6, or 9, etc.; in Case III, 4, 8 or 12, etc.; in Case IV, 6, 12, or 18, etc.

But although the latitude allowed for the width of the ridge usually

allows the field to be subdivided as required, it is not always either possible or desirable to do so. On the other hand it must be admitted that all these solutions are rather complicated and require much attention from the driver, if not even numbers placed on the ridges to avoid doubt or errors in turning. This is why, in the United States, where the fields are extreme-

*Simplified method of continuous ploughing in ridges advised  
in the United States.*

Fig. 19. — Solution B  
of Case I.

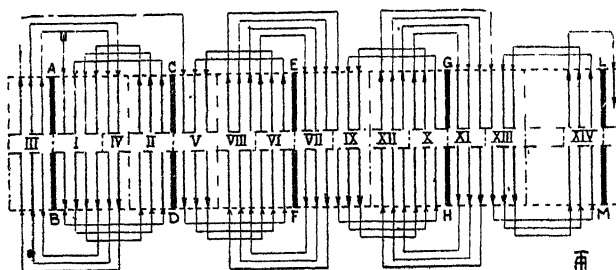
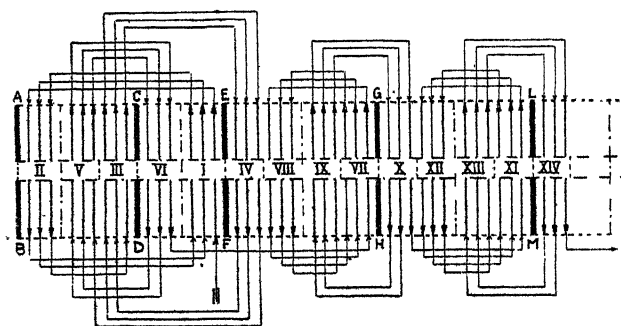


Fig. 20. — Solution A  
of Case I, obtained  
by applying that  
method.



ly large and where the uniformity of the ridges is only of secondary importance, more simple methods are advised which might be called the system of *continuous* ploughing as the *cycle* is shortened and instead of closing, continues indefinitely.

One of these procedures, given in "*Farm Power*"; (published by the INTERNATIONAL HARVESTER COMPANY, Chicago, 1915) and reproduced in various French periodicals (such as *Le Génie Rural*, 1917, No. 66), can be applied to our Case I (ridges more than 82 ft. wide). It is shown in Fig. 19 which corresponds to our Solution B of Case I, while Fig. 20 shows the Solution A obtained by applying it.

As is shown in these figures, the first two ridges are narrower than the following ones; which might prove disadvantageous for certain crops. In

any case we submit the variants shown in Figs. 21 and 22, in which the unequal ridges are reduced to one only.

*Variants of the continuous method proposed by the author.*

Fig. 21. — Solution B of Case I (see Fig. 19).

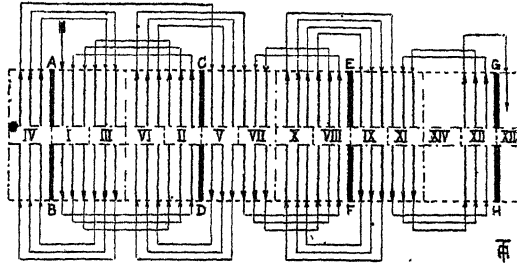
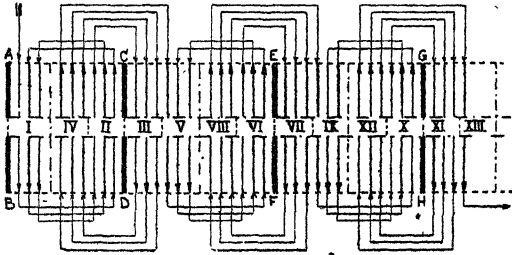


Fig. 22. — Solution A of Case I (see Fig. 20).



But, if it was desired to employ the system of continuous ploughing, the method might be simplified still further and applied to all the cases

*Simplified continuous method proposed by the author.*

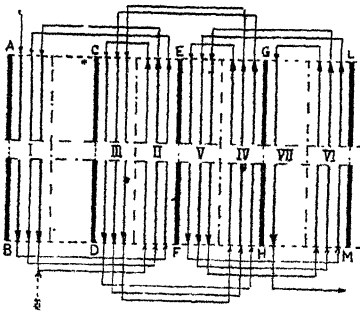


Fig. 23. — Case II: Ridges from 49 to 82 ft. wide.

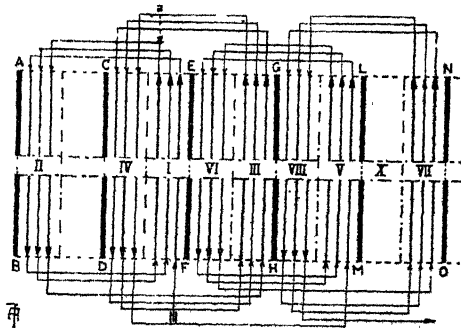


Fig. 24. — Case III: Ridges from 20 to 49 ft. wide.

previously considered. In Figs. 23, 24, 25 a few examples of the application to various cases are shown.

*Simplified continuous method proposed by the author.*

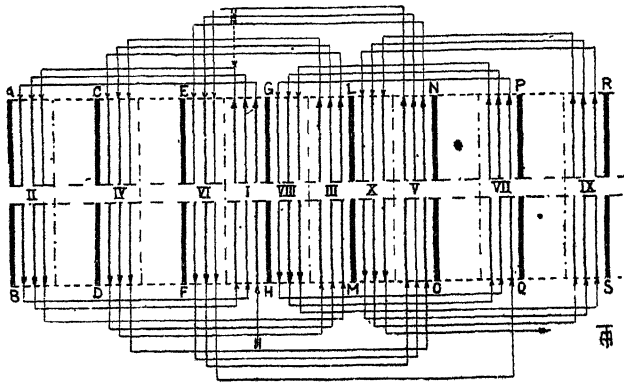


Fig. 25. — Case IV: Ridges less than 29 ft. wide.

The last methods do away with the complicated manoeuvres required with the previous procedures when starting ploughing, but the idea must be abandoned of ploughing one, or, at a maximum, two zones, both at the beginning and end of ploughing. These zones would then be ploughed separately, either with the machine before commencing continuous ploughing or with a team afterwards. Again they might serve to allow the ploughs to pass to finish the work, thus replacing the side headlands.

SECOND PART  
ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1068 - The Organisation of Colonial Agriculture in Indo-China and France.—CHEVALIER, A., Report presented to the *Congrès d'Agriculture coloniale organisé par l'Union coloniale française*, Government of Indo-China, Saigon Series, *Bulletin* No. 13, 64 pp. Saigon, 1918.

DEVELOPMENT  
OF  
AGRICULTURE  
IN VARIOUS  
COUNTRIES

When, in 1917, it was decided to organise a congress of colonial agriculture at Paris, the president of the congress, M. J. CHAILLEY and the organising committee asked the author (Chief of the Permanent Agricultural Mission at the Colonial Ministry) to draw up a report for the section for the study of the organisation of the colonial agriculture departments in France and the colonies. This report was to contain the observations made by the author in the course of his missions, so that the section should be informed of the organisations necessary both at home and in the colonies.

The author left for Indo-China where he was commissioned by the Governor General, M. ALBERT SARRAULT, to inspect the agricultural and forestry services with a view to giving advice for the rapid intensification of production during and after the war. It was on this instructive inspection that the author based his report to the congress. The organisation of agriculture in Indo-China and the progress made in the country since the French occupation are discussed, thus bringing to light the great efforts made by the natives and the French colonising organisation. He shows the mistakes made in the past, the early attempts of the colonists and the instability of the agricultural experiment stations. It is necessary that an end should be made of the old habits, *i. e.*, lack of coordination and perseverance. The programme drawn up by M. SARRAULT for his collaborators includes first and foremost the combination in every branch of all energies and labour for the development of the colony. Reforms are now being introduced throughout the agricultural service of Indo-China. They are given by the author in the first part of his work, entitled "*The organisation of Agriculture in Indo-China*".

[Abstract No. 1068]

If the latent wealth of a country is measured by the variety of raw materials it produces, then Indo-China must be placed among the most important of the French colonies, by reason of its mineral resources, its sea produce, forest wealth, numerous crops grown or capable of being grown. Inhabited by hard-working, intelligent and civilised races, Indo-China was already well developed economically when the French settled there. Nevertheless it is necessary to improve the agricultural methods in order to increase the yields of the crops and obtain the maximum yield from the land.

Cochin-China was fortunate in having for a long time at the head of its Botanical Service the botanist LOUIS PIERRE, who lived there for 12 years and contributed largely to the study of its crops and introduced numerous useful plants. He founded the Zoological and Botanical Garden of Saïgon in 1865, soon after the annexation of Cochin-China, and continued to direct it till 1878.

The experimental work was chiefly concerned with sugar cane, maize, rice (of which about 200 varieties were collected), Leguminosae, forage plants (teosinte and Para grass, now acclimatised), textiles (ramie, cotton, jute), tobacco, pepper, vanilla, and fruit trees. Already at that time the necessity of manuring all crops had been shown. Over 400 000 coffee plants were distributed in a few years, the first experiments in the growing of coffee on a large scale made, and several varieties introduced from Bourbon and Java. PIERRE also studied plant diseases as well as the introduction of rubber and gutta-percha plants (he discovered *Dichopsis Krantziana* in the forests of Cochin-China and Cambodia).

A list is given of the institutions in Cochin-China devoted to the development of agriculture.

In 1886 PAUL BERT founded the "*Comité d'études agricoles industrielles et commerciales du Tonkin*" (Committee for agricultural, industrial, and commercial studies of Tonkin). A school of agriculture was founded at Hanoi and made into a Botanical Garden in 1889. In 1897 an *Agricultural Board* was formed at Tonkin. M. P. DOUMER created in 1898 a *Board of Agriculture and Commerce* which, in 1901, was changed into the *Board of Agriculture, Forestry and Commerce*. Local agricultural services were installed in Annam, Cochin-China and Cambodia. In the meantime a *Forestry Service* and a *Veterinary, Zootechnical and Epizootic Service* had been organised. Mention should also be made of the establishment at Saïgon and Hanoi in 1889 of laboratories for agricultural and commercial analysis and, lately, of a Service for the repression of fraud, of the founding of the *agricultural, commercial and industrial museum* at Hanoi in 1902 and of a similar one at Hué in 1915; two others will shortly be formed at Saïgon and Cambodia. Other scientific services and institutions which are not directly concerned with agriculture but of great use to it are:— 1) *the Irrigation and Dredging Service*; 2) *Geological Service*; 3) *Meteorological Service*; 4) *library of the Far-East French School* at Hanoi; 5) *Board of higher education* (University of Indo-China); 6) *Far-East scientific mission*, which, unfortunately, was very short-lived; 7) *Pasteur Institute of Nhai-rang* and its Saïgon branch;



8) *Naval arsenal* at Saïgon, which may be used for testing materials.

To these institutions must be added, on the one hand, three societies, mostly composed of European colonists engaged in agriculture, on the other, the private societies of planters or exporters of agricultural products. The first group includes: — 1) the *Cochin-China Chamber of Agriculture*; 2) the *Chamber of Agriculture of Tonkin and North Annam*; 3) the *Mixed Consultative Chamber of Commerce and Agriculture of Cambodia*. Among the private societies may be mentioned: — 1) the *Association of Rubber Planters of Indo-China* which publishes *Les Annales des planteurs de caoutchouc*; its headquarters are at Saïgon; 2) the *Syndicate of Rice Exporters of Indo-China*.

In 1903 it was decided to establish a certain number of experiment stations in Indo-China and they were opened between 1904 and 1908. Unfortunately the *Board of Agriculture, Forestry and Commerce*, as well as the technical services depending on it, was suppressed in 1909. At the present time it is replaced by a *Service of Economic Affairs* (order of December 21, 1911). By the order of June 6, 1917, the Governor General formed a *Mission for the Inspection of Agriculture and Forests in Indo-China*.

From the first moment of his arrival in Indo-China, the Governor-General, M. SARRAULT, acting on the suggestion of the Director of the Economic Services, M. H. BRENIER, decided to form new specialised experiment stations devoted to the principal products of the country. The first, established in Cochin-China should have dealt with the selection and cultivation of rice. The war has made it impossible to realise this programme completely; nevertheless a *Rice-Selection Service* is now working the Laboratory of Saïgon and the Rice Station of Cantho. It has done useful work on the agricultural characters and commercial value of different varieties, and has introduced to the markets of the mother country "terê-ky" rice, which has been much appreciated there and the cultivation of which is spreading greatly in Western Cochin-China. According to experts, this rice may take the place of Spanish rices, which in Europe have a much greater value than those imported from Indo-China. As soon as normal conditions prevail the Cantho Station will make experiments in mechanical cultivation and other tests, in order to improve the agricultural implements and machinery at present used by the natives.

An experiment station for maize selection was established in 1914 at Tuyenquang. It has recently been transformed into a modern farm so as to experiment not only with maize, but with all the native crops of the Tonkin Delta and central district, especially those plants which might be grown in rotation with maize. An experiment station for cotton selection is now being organised in Cambodia. The formation of stations for coffee and tea growing in Tonkin and Annam is under consideration and will probably be carried out when conditions make it possible to obtain a competent staff to direct them.

The organisation described is only the first step toward the establishment of specialised stations for each kind of local crop. Finally, silkworm egg stations and model silkworm breeding centres, experimental mulberry

plantations and factories for native silk-spinning should be formed in all parts of Indo-China where they do not yet exist.

The work of the European colonists is described and stress laid on their efforts to develop the crops in the Colony. It may be said without exaggeration that the cultivation of coffee in Tonkin, Cochin-China and North Annam and that of rubber in Cochin-China and South Annam has been perfected to the same extent as in the Dutch Indies and the Malay Peninsula, where it has been practised much longer. These crops are still grown only over limited areas — 49 400 acres for rubber and 6 200 for coffee. Tea-growing also shows great promise, especially if the companies, which have already studied the question and considered making large plantations on the slopes of the Lang-biang, or in the Tourane district, turn their attention to the improving of the cultural methods and the preparation of the product.

Certain other crops are now attracting the attention of the European colonists, especially cotton, in Cambodia, coconut, oil palm (*Elaeis*), and sugar-cane in Cochin-China and Annam, and tobacco, jute, and starch plants in Annam and Tonkin.

As soon as circumstances permit, the Governor General has decided to establish an Institute for scientific research devoted to native agriculture, European enterprises, and local agricultural and forestry services, for the improvement of the industrial value of the country. This Institute will doubtless be placed in the plain of Giarai, at the foot of the volcanic mountain Nui-chua-chou (over 2 620 ft. high; and with a temperature at the summit frequently at 8° C. lower than at Saigon), three hours' distance from Saigon. This Institute will have two departments — 1) the Institute properly speaking, including laboratories, and library, on the mountain; 2) the botanical garden and experimental fields, at the foot of the mountain.

The organisation of the future Institute of Giarai which is to become the "Buitenzorg of Indo-China", is then discussed in detail, and special stress is laid on the decisions of M. SARRAULT with respect to the organisation of agricultural and forestry instruction in Indo-China. By the order of July 8, 1917, an Indo-Chinese University was founded for the higher education of colonists and natives. The instruction is to include a School of Medicine and Pharmacy, a Veterinary School, School of Agriculture and Forestry, School of Pedagogy, School of Administration and Law, a Central School with special departments for Public Works, Electricity, Commercial Chemistry, Architecture and Building, a Higher School of Navigation and Fisheries. At the same time as it was decided to establish these schools, there was organised a School of Science, affiliated to the School of Medicine of Hanoi, to prepare for the first three grades of the above mentioned schools. Practical schools of agriculture will also be formed.

The author then passes to the improvement of the social condition of the natives, the outlet for the agricultural and forestry products provided by the *Agence économique de l'Indochine* (an organ recently formed by M. SARRAULT to bring the producers of the colony into touch with the manufacturers and merchants of the home country), statistics (which are to be

drawn up by a special department of the Economic Service of the Government), the sending of supplies to France, and transport.

The second part of the report is devoted to the reforms which appear essential, in France as well, for the organisation of the Service of Colonial Agriculture. Taking as an example the work that has been done in Indo-China, it should be possible to improve the agricultural services in all the other French colonies. Most of the institutions being established in Indo-China should be established successively in all the other French possessions, leaving, of course, free scope to each to adapt these institutions to its own requirements. Since Indo-China has set the example and, thanks to its new organisation, is much more advanced than the others, it would be well if specialists leaving the Universities and large schools of France with a view to entering the colonial service were to stay a few months in the Far East colony.

At the present time there are many institutions in France cooperating in the scientific study of agriculture in the French colonies, but they are in no way connected, and have but a very limited action. In Paris and neighbourhood alone there are the following institutions supported or subsidised by the Colonial Ministry or local grants:—

- 1) The *Mission permanente d'Agriculture coloniale*, considered as the general inspection department of colonial agriculture, but possessing only a very limited staff and restricted power of action ;
- 2) the *Jardin colonial de Nogent-sur-Marne* with the *École supérieure d'Agriculture coloniale* affiliated to it ;
- 3) the *Laboratoire d'Agronomie coloniale de l'École des Hautes-Etudes*, in the Museum of Natural History, which is a branch of the permanent Mission ;
- 4) the *Laboratoire de Biologie coloniale au Muséum d'Histoire naturelle* ;
- 5) the *Laboratoire de Matière médicale de l'École supérieure de Pharmacie* ;
- 6) the *Research Service of the Colonial Office* ;
- 7) the *Maîtrise de conférences de Botanique coloniale* at the Sorbonne, etc.

In many of the large towns, Marseilles, Bordeaux, Lyons, Nancy, there are also colonial Institutes or courses which, especially at Marseilles, contribute valuable work to colonisation. It would be well to unite into one at least the most important of these institutions.

The organisation of the agricultural services of the colonies calls for the formation of a new Central Service or Service of Inspection in each of the governments, or in each of the principal independent colonies, each federated colony having its local service. The work of each service, the research of each station and laboratory should, however, be coordinated. For this reason there should be in each colonial government a head of such service, dependant on the governor, whom he should advise as to the scientific help necessary to the colony.

The functions of a scientific agricultural service in the colonies must be restricted to technical work and consist of investigations and experiments, taking into consideration the requirements of the colonists and natives, and should bring pressure to bear on them to introduce improvements.

It is necessary to organise an Agricultural Service at the Colonial Ministry to coordinate and control the research carried out in the colonies by the colonial agriculture services. This Central Service would have the general direction of the others and control their activities.

1069 - **Agriculture in Cyprus.** — See No. 1075 of this *Review*

RURAL  
HYGIENE

1070 - **On the Bactericidal Action of Sunlight (Total White Light and Partial or Coloured Lights).** — DE LAROQUETTE, M., in *Annales de l'Institut Pasteur*, Year XXXII, No. 4, pp. 170-192 + 3 Figs. Paris, April, 1918.

The action of sunlight on bacteria has been considered above all as a destructive action in which chemical rays, especially ultra-violet rays, play an almost exclusive part. Numerous facts, however, especially in warm countries, where bacteria are not lacking in spite of the amount of sun, seem to show that the bactericidal action of sunlight is neither as efficient nor as constant as is generally believed, and that special conditions are required for its action.

The author sought to solve experimentally the following questions:—

- 1) To what extent has sunlight a bactericidal action in the air, in liquids and solids?
- 2) To what depth does its action penetrate under these conditions?
- 3) What intensity and duration of insolation does this action demand?
- 4) How does it act?
- 5) Is the action chemical, calorific, or desiccative?
- 6) What are the differences in this respect between the various rays of the solar spectrum?

The experiments were made at Algiers in two principal series:— from May to July, 1914, and from November to December, 1916. In the first, made in summer, the bacteria were acted on with the maximum intensity of sunlight. In the second, made in autumn, moderate intensities could be used similar to those in the north of France. In some of them white or coloured (blue, green, yellow, red) greenhouses built north-south were used. In these plants, bacteria, moulds, and various animal species were grown continually, from 1911 to 1914.

The results obtained from the various experiments were as follows:—

Prolonged, vigorous insolation greatly reduces the bacterial content of air but does not sterilise it completely. At a depth of 10 mm. under water *Bacterium coli* resisted very strong insolation for 5 hours; at a depth of 2.5 mm. it was killed, even through the glass of a closed Petri dish, by 3 or 4 hours' insolation. The *B. coli* killed in 4 hours in 20 cc. of water at a depth of 2.5 mm. had resisted for 7 hours in 40 cc. at a depth of 5 mm. Filtration of the rays through 1 cm. of water which absorbs part of the infra-red and ultra-violet did not modify the results previously obtained with the full light. Continuous cooling of the dish by ice decreased evaporation and prevented the sterilisation of the water. This shows heat to play an important part in the bactericidal action of sunlight which appears, partly, to act by evaporation. Filtration of light through glass of any colour greatly reduces its evaporation power and, at the same time, its bactericidal action. *B. coli* in broth in a 15 mm. test tube resisted strong insolation during 6 hours, but was killed in 8 hours; spread out in thin layers of 2.5 mm. it was destroyed by 4 to 5 hours' insolation; in tubes it lived in diffused

white and coloured light for 43 days. *B. Coli* on potato resisted 7 hours' strong insolation. On gelatine *B. coli* in open dishes was killed by 2 hours' insolation; under coloured glass as in the open air, it was killed by 7 hours' insolation. Under uncoloured thick glass and under a cover full of water which absorbed the greater part of the infra-red and ultra-violet rays, it was killed by 4 hours' insolation, whereas it resisted under all the coloured glasses, even the blue. When thin layers (1 mm.) of skin, fat or muscle protected the gelatine cultures of *B. coli* exposed to the sun for 5 hours they were not killed. When ice surrounded the dish, thus preventing desiccation of the gelatine and the cultures the bacteria resisted 4 hours' strong insolation, even when completely exposed. Gelatine cultures of Eberth's bacillus are killed by 2 hours' insolation; a very thin layer (about 0.5 mm.) of vaseline delays destruction for about 1 hour. Streptococci and *Staphylococcus citreus* in tubes on potato and in broth withstood 7 hours' insolation. On paper *S. citreus* lived in all the greenhouses, except that with colourless glass, for 22 days; it died in all of them, except the green and the black, in 38 days; on gelatine in tubes it resisted moderate insolation everywhere during 16 days. In gelatine tubes the cholera vibrio grew well in all lights except white, and withstood 38 hours' insolation everywhere. *Micrococcus mabittensis* on gelatine in tubes developed everywhere, except under green glass; under white it was destroyed more rapidly than under black; on broth it grew moderately in white and blue light and died soon; in red and black light it did not grow though it lived 20 days. Cultures of Hérelle's coccobacillus on gelatine and on paper grew well in all the houses, drying up and becoming sterilised in white, blue and yellow light. They resisted 38 hours' insolation in the green, red and black; on paper they were sterilised in 21 days in white, blue, green and yellow light. *Sarcina rosea* on gelatine did well in all the houses, but there was a little delay under black. Grape yeasts on gelatine in plates gave good cultures which developed quickly everywhere; they were stopped twice out of 6 times and modified 4 out of 6 times in white light (desiccation of colonies and medium); continuously in the other lights the cultures are a little flattened after the 10th day, especially in white and blue light; the yeasts were alive everywhere at the end of 38 days except in 2 out of 6 in the white light. In tubes of must fermentation was intense everywhere, but slightly hastened by light, especially white; the yeasts were alive in all the tubes after 38 days. The paper was sterilised in 21 days in white, blue and yellow light; and in 38 days in all the glass houses. Yeasts appear to be especially subject to desiccation.

CONCLUSIONS. — Sunlight is only bactericidal with prolonged or direct isolation; it acts particularly on the surface of dry media and in air where bacteria are more exposed to sun rays and desiccation. In liquid media the bacteria are only destroyed when the light is very intense and at shallow depths. Total white light is much more active than any partially coloured light. Diffused light is insufficient. Blue light is slightly more bactericidal than other coloured lights, but much less so than white light; yellow comes next, then red and, lastly, green which, for bacteria as for plants is most closely related to black.

The most active part of the solar spectrum is the luminous part; ultra-violet has a slight action in the bactericidal effect of sunlight; filtration through a thick glass which absorbs most of the solar ultra-violet did not perceptibly diminish these effects. The same applies to infra-red; filtration of sunlight through water did not inhibit its bactericidal action. Nevertheless heat plays a certain part; cooling with ice during insolation delayed the death of the bacteria and the desiccation of the medium.

The bactericidal power of the rays appears to be connected both with their chemical action and their dehydrating action (on the protoplasm and culture medium) and, the author believes, more particularly to the latter, which, however, is not exclusive, since it cannot act efficiently in liquid or strongly hydrated media. In this case it would be due to a kind of kinetic shock or poisoning by excessive energy.

Finally the death of bacteria exposed to the sun seems to be caused by too great an absorption of energy, of which the first effect is usually dehydration and coagulation of the protoplasm. As it is only the energy absorbed which acts, the so-called chemical rays with the shortest waves are most active on the surface, probably because they are most largely absorbed by the bacteria and media. At a depth, however, the more penetrating calorific rays are more efficient, but can produce no bactericidal effects because of their progressive filtration and slight density. Moreover, all rays, like all forms of energy, are destructive or beneficial for living protoplasm, and consequently for bacteria, according to the quantity absorbed, and there is no specific action properly speaking. In the bactericidal effect exposure to the air which usually accompanies exposure to the sun must also be taken into consideration as it contributes very largely to the desiccation of the bacteria and media.

In practice, both in hygiene and therapeutics, it would be useless to rely largely on the bactericidal action of sunlight, especially in temperate districts, as it has no effect at a depth exceeding a few millimetres and is inhibited by thin layers of fat or muscle.

**1071 - Researches, from the Standpoint of Food Hygiene, on the Ganglionic and Muscular Virulence of Macroscopically Healthy Organs in Generalised Bovine and Swine Tuberculosis.**—CHAUSSE, P., in the *Annales de l'Institut Pasteur*, Year XXXI, No. 1, pp. 1-18 + 4 Tables + Bibliography of 29 Publications. Paris, 1917.

When discussing the historical aspect of the question the author remarks that no value whatever should be attributed to those researches carried out by ingestion; he has found that even the guinea-pig readily resists the ingestion of several million, very virulent bacteria and a still stronger quantity of virus if this consists of coarsely ground bovine tubercle material. He also finds that researches by inoculation are insufficiently searching for several reasons and faults of technique. Three "historical" tables show, with the results obtained, all tests of the virulence of muscle and ganglions, whether by inoculation or by ingestion.

The author attempted to throw light on the question of ganglionic and muscular virulence as regards food hygiene by acting as follows:—60 samples (18 pigs and 42 cattle slaughtered for food and seized for gene-

ralised tuberculosis) were inoculated subcutaneously into guinea-pigs (3.5 subjects for each inoculation) *in the form of muscle juice* and also *in the form of tissue fragments*. The guinea-pigs were killed 45 days after inoculation and in no post mortem examination was tuberculosis found.

The ganglia of the seized animals are rarely attacked in a visible manner; many are of quite normal aspect and the author tried to find whether the macroscopically healthy ganglia are virulent. The extra-visceral ganglia removed were arranged in symmetrical pairs (*e. g.*, 2 popliteal, 2 crural, etc.); the juice and pulp were inoculated subcutaneously into guinea-pigs. Virulence was found: —

a) for the 9 pairs of ganglia from the pig, *twice*, in each positive case, with 3 tuberculous guinea-pigs out of 3 survivors;

b) for the 44 pairs of ganglia from the cow, *11 times*, with, in these cases, 100 % of tuberculous guinea-pigs and, in other cases, the half or two-thirds.

CONCLUSIONS. — 1) From the 60 negative results obtained in the muscle tests, this tissue is not virulent practically; in consequence the consumption of muscle, even when raw, of subjects affected with generalised lesions, has no appreciable danger.

2) The consumption of macroscopically healthy lymphatic ganglia is not without danger when they are insufficiently cooked.

The law is therefore right, in allowing the consumption of meat from tuberculous animals after sterilisation and removal of the ganglia. But, notwithstanding scientific evidence the sale of such meat at low prices after sterilisation is against popular opinion and, in normal times, the greater part of such meat is lost. The author therefore suggests as a remedy that the State should buy such meat at a low price and preserve it, for use in penitentiary establishments.

1072 — **Rice and the Chemistry of Food.** — GUARESCHI, I., in *Annali della R. Accademia d'Agricoltura di Torino*, Vol. LX, 1917, pp. 41-77. Turin, 1918.

Rice is a more nourishing cereal than supposed and richer in albuminoids than indicated by the old analyses. The substances hitherto found in "riso svestito" (hulled rice, *i.e.* freed from its glumelles but not decorticated) are: —

*Water*; *nitrogenous matter* (albuminoids), globulin, edestine, or phytovitelline, glutenin or gluten-casein, gluten-fibrin; *vitamines*, in the external layers; *ferments*, lipases, cytases, diastases; *carbohydrates*, starch, fibre, hemicellulose, arabinoxylane, xylane ( $C_5H_8O_4$ ), sugar, gum; *fat*, (riceoil), free oleic acid, glycerides of arachic, behenic or lignoceric acids; *phosphatides*, phytin or salt (Ca, Mg) of anhydro-oxi-methylene-di-phosphoric acid; *minerals*, especially potassium phosphate with magnesium phosphate, etc.

The average composition per cent. of good hulled rice is: —

Moisture 13.17, nitrogen 8.13, fats 1.29, nitrogen-free extract 75.5, crude fibre 0.88, ash 1.03.

All the chemical elements contained in rice are suitable as food. The nitrogen content may reach, or even exceed, 9 %; Piedmontese rice is

superior to rice from India, Japan and Java in this. The albuminoids of rice, are included in the so-called whole albuminoids because the products of their hydrolysis include phenylalanine, tyrosine and tryptophane.

The most important substances and those which have a beneficial influence on the nutrition of the nervous system are found especially, and in some cases exclusively, in the pericarp or external coat of the grain. They are vitamins, phosphates of potash and magnesium, phosphatides, and ferments.

From 100 lb. of "riso vestito" or "risone" (paddy) are obtained: — 75-80 lb. of "riso svestito", "sbramato" or "bruno" (hulled rice), 65 lb. of "riso bianco mercantile" (white commercial rice), 62 lb. of "riso camolino" or "levigato" (polished rice), 59 lb. of "riso brillato" (coated rice), 55 lb. of "riso brillato stella" or "perla" (fancy head). From 20 to 25 lb. are, therefore, lost and can be used only as a food for live stock.

The by-products from the decortication of rice (pula) contain no phosphates, but there is much phosphoric acid in the by-products from the decortication and polishing of rice. They contain, moreover, all the vitamins. Polished rice contains no vitamins, the organic compounds of an alkaloid nature necessary to animal life. Polished rice, even when eaten with other nutritious foods more or less rich in vitamins, will always be inferior to rice which has been prepared little.

The people of the districts of Novara, Vercelli, Cremona, etc., who live largely on unpolished rice, thrive well on it, but this would certainly not be so with polished rice because excessive polishing (an almost modern operation) lowers the food value of rice. Asiatic peoples, who have used unpolished rice as their principal food since remote times do not suffer from the special diseases caused by under-nutrition. It is in those places where polished rice has been introduced that special diseases, particularly beri-beri which previously occurred rarely, have developed. Investigations made from 1896 to 1914 have shown that polished rice eaten with or without other foods, can produce serious diseases due to under-nutrition, especially in the nervous system, and that even with really nutritious foods, it will always be inferior to rice in the most natural state.

The author refers to the investigations made by English and American chemists and physiologists into diseases caused by the continual use of decorticated cereals, especially beri-beri (polyneuritis) caused by decorticated rice and particularly by polished rice, *i. e.* rice completely deprived of its outer layers. Photographs are given of hens fed on white or polished rice. In a short time the birds contract polyneuritis and die, whereas others fed on undecorticated rice, do very well. Attention is drawn to the work of C. Funk who, in 1912, isolated from rice bran a vitamin which rapidly cures, and even prevents beri-beri (1).

From all points of view, chemical, physiological, economical, the use of rice prepared excessively, and especially polished, should be absolutely abolished. It is said that polishing is necessary for keeping rice and making it fit for transport, etc. The rice kept for over a century and analysed

(1) As regards vitamins, polyneuritis, etc., see R. Aug., 1918, Nos. 833, 824 and 835; R. July, 1918, No. 719 with the note. (Ed.)



by BALLAND was, however, not polished rice, nor is that which comes to Europe from very distant countries. The rice imported into Europe is paddy and partially prepared rice, such as exported by Italy, polished rice ("rafinato" or "camolino") cannot stand journeys.

In healthy and rational feeding unpolished rice and rice prepared to a slight extent only should be used as polishing is opposed to all the scientific and practical laws of feeding.

1073 - **Coffee Substitutes Made with Lupin (1) and their Disadvantages.** — ECKENROTH, H (National Institute of Hygiene, Lodz), in *Zeitschrift für Untersuchung der Nahrungs- und Genussmittel*, Vol. VI, No. 35, pp. 240-242. Münster, 1918.

At the present day coffee substitutes containing as much as 50 % of lupins are being used in Germany. The infusion made from these substitutes has an exceeding bitter flavour, difficult to improve by the addition of sugar or milk. This proves that the toxic substance contained in the lupins (lupinin) has not been removed. Roasting is not sufficient to eliminate this substance, although some workers maintain it is, and recent investigations (BRAUER and LOESNER) show that lupins if inefficiently treated and consumed as in these substitutes can cause illness and must be considered as unfit for human consumption. For this reason the measures already taken in Austria to prohibit the use of lupins as a food should be adopted everywhere unless there is sufficient guarantee that the requisite preliminary treatment has been carried out.

1074 - **The Antiseptic Value of Some Essential Oils.** — CAVEL, L., in *Comptes Rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 20, pp. 827-829. Paris, May 21, 1918.

The author classified a certain number of essential oils according to their antiseptic value, by determining for each the minimum quantity necessary to prevent all bacterial growth in ordinary neutralised meat broth plentifully sprinkled with water from a septic source. The inhibiting quantity of phenol under the same experimental conditions being 5.6 ‰ the author obtained the following classification for essential oils according to the quantity required to inhibit growth:—

Thyme 0.7 ‰; marjoram 1.0; orange-peel oil 1.2; verbena 1.6; cassia 1.7; rose 1.8; clove 2.0, eucalyptus 2.25; mint 2.5; geranium (Rose de France) 2.5; vetiver 2.7; bitter almond 2.8; gaultheria 3.0; geranium (Indian) 3.1; winter-green 3.2; meadowsweet 3.3; spike-lavender 3.5; aniseed tree 3.7; iris 3.8; common cinnamon 4.0; wild thyme 4.0; birch 4.8; anise 4.2; mustard 4.2; rosemary 4.3; cumin 4.5; neroli 4.75; lavender 5; balm 5.2; ylang-ylang 5.6; juniper 6.0; sweet fennel 6.5; reseda 6.5; garlic 6.5; lemon 7.0; cajeput 7.2; saffrafr 7.5; heliotrope 8.0; cedrate 8.4; turpentine 8.6; parsley 8.8; violet 9.0; camphor 10.0; angelica 10.0; patchouly 15.0.

Seven months after inoculation the culture plates were still sterile when the above quantities were used.

(1) For other coffee substitutes recently put on the market see R. Nov. and Dec., 1917, Nos. 1022 and 1131. See also No. 1134 of this *Review*. (Ed.)

EXPERIMENTAL  
AND  
ANALYTICAL  
WORK

1075 - Recent Investigations at the Imperial Institute (1). — *Bulletin of the Imperial Institute*, Vol. XV, No. 3, pp. 297-334, 333-440. London, July-September, 1917.

AGRICULTURAL PRODUCTS OF CYPRUS (2). — Cyprus is essentially an agricultural country and most of its exports consist in products of the soil. In 1915 the quantities of the most important products were:— wheat 1 750 000 bushels, barley 1 900 000 bushels, oats 375 000 bushels, cotton 23 982 cwt., silk cocoons 651 207 lb., olives 59 756 cwt., grapes 479 719 cwt., carobs 245 914 cwt., pomegranates 115 396 cwt. The exports also include oranges, lemons, wool, hides, etc. The Agricultural Department was re-organised in 1913. There are an agricultural school, summer vacation courses for school masters, and travelling instructors. The Agricultural Department has undertaken experiments with new crops, especially fodders and foodstuffs (of these last rye and lucerne are now being grown by the farmers), the introduction of new varieties of tobacco and cotton, the improvement of vine and olive cultivation, silkworm breeding, bee-keeping, and methods of controlling insect pests and fungoid diseases, etc.

At the Agricultural Stations of Nicosia, Ashia and Akaki the Allen's Improved Long Staple, Mebane's Early Triumph, and Sakellarides varieties of cotton have been cultivated and, in addition, the New Orleans variety, grown to a fair extent in Cyprus, was also cultivated at Nicosia. At these stations, the highest yields were obtained with Triumph, which gave 271 lb. of lint per acre at Nicosia and 373 lb. at the two other stations; this variety was also the earliest. Samples of Allen's Improved and Mebane's Triumph were examined at the Imperial Institute and gave good results.

Table I shows the composition of some essential oils extracted from seeds or plants in Cyprus, as well as of the cake, according to the analyses of the Imperial Institute. Aniseed (*Pimpinella Anisum*), of which 1 000 to 2 000 cwt. are exported annually, was sold at London before the war at 27s. 6d. per cwt. The seeds yielded 2.8 % of essential oil. The cake contains neither alkaloids nor cyanogenetic glucosides, and may be used as a cattle-food. Coriander seeds (*Coriandrum sativum*) gave, by steam distillation, 0.48 % of essential oil, white cumin seeds (*Cuminum Cyminum*) 3.4 % of oil containing about 50 % of aldehydes, and black cumin seeds (*Nigella sativa*) 0.3 %. The cake of the first species contains no alkaloids or cyanogenetic glucosides, that of the last two contains a trace of alkaloid, so that their use is not advisable unless trials are previously made. The essential oil of black cumin seeds has no commercial value because of its disagreeable odour. The fixed oil, extracted with solvents (44.8 % of the seeds is estimated to be anhydrous) is brown and has a pronounced flavour and odour, so that its use as an oil-seed is only advisable when there is a scarcity of other oil-seeds. Its properties are:— specific gravity 0.8614, solidifying point of fatty acids 22.3° C., acid value 101.2, saponification value 198.0, iodine value 123.8 %, unsaponifiable matter 0.9 %.

The ordinary organum oil produced in Cyprus is obtained by the distillation of *Origanum dubium*. In 1913 a new form, locally known as "rik-

(1) See R. Jan., 1918, No. 5. — (2) See also R. April, 1918, No. 376. (Ed.).

hanon" was found near Lapithos and subsequently described by HOLMES as a new species under the name of *O. Bevanii*. Dried plants in flower (without the roots) yielded 1.9 % of essential oil, i. e., about half that obtained from ordinary origanum. This oil contains about 75 % of phenols which, instead of containing only one carvacrol, as those of *O. dubium*, consist of a mixture of approximately 41 parts of carvacrol and 34 of thymol.

TABLE I. — *Composition of the essential oils of Cyprus and their cakes.*

	<i>Pimpinella</i> <i>Anisum</i>	<i>Coriandrum</i> <i>sativum</i>	<i>Cuminum</i> <i>Cymium</i>	<i>Origanum</i> <i>Bevanii</i>
<i>Essential oils:</i>				
Specific gravity at 15° C . .	0.990	0.879	0.956	0.951
Optical rotation in 100 mm. tube . . . . .	0°.	+ 12' 20'	+ 1' 30'	+ 0" 24'
Refractive index . . . . .	1.557 at 24° C	1.467 at 20° C	1.510 at 23° C	1.51 at 23° C
Solubility in 90 % alcohol:				
soluble in . . . . .	2.8 vols at 15° C	1.9 at 15° C	1.1	2.7 at 15° C
Solidification point . . . .	17° 5 C	—	—	—
<i>Cake:</i>				
Moisture . . . . .	6.0 %	6.5 %	8.7 %	
Crude proteins . . . . .	21.3 "	12.8 "	17.6 "	
Consisting of: true proteins .	19.3 %	11.5 %	17.2 %	
Other nitrogenous substances	2.0 "	1.3 "	0.4 "	
Fat . . . . .	29.7 %	15.6 %	30.0 %	
Starch, etc. (by difference) .	26.9 "	26.7 "	27.9 "	
Fibre . . . . .	10.9 "	29.2 "	10.2 "	
Ash . . . . .	5.2 "	9.2 "	5.6 "	
Nutrient ratio . . . . .	1:4.5	1:4.9	1:5.5	
Food units . . . . .	154	98	147	

Kyko oats from Cyprus were cultivated at Kew, where they were identified as *Avena sativa* var. *obtusata* Alef. They are commonly cultivated in South-Eastern Europe as well as in France, where they are known as Avoine blanche de Hongrie, de Pavolie, de Turquie, or de Russie. At Kew they reached a height of from 5 to 6 ft. without the roots but including the heads which were about 1 ft. long. The analyses given in Table II were made from plants in flower. The composition of white cumin chaff shows it be of great food value.

Squill (*Urginea Scilla* = *Scilla maritima*) is fairly common in Cyprus, but is not utilised. Dried slices of the bulb sent to the Imperial Institute were declared to be unsaleable because of their brown colour as the British and United States Pharmacopœias only accept yellowish-white bulbs. There are two varieties of squill, one with white bulbs, the other with red bulbs (the Cyprus squill belongs to the latter variety); both are of equal medicinal value.

TABLE II. — *Percentage composition of Cyprus grains. chaff and hay.*

	Chick peas	Oats	Oat straw	Kyko oat hay	White cumin chaff (stems and seeds)
Moisture . . . . .	10.3	8.4	8.9	8.8	10.6
Crude protein . . . . .	21.7	8.9	2.6	5.4	9.6
Consisting of: true proteins . .	18.6	7.9	2.1	3.7	7.3
Other nitrogenous substances .	3.1	1.0	0.5	1.7	2.3
Fat . . . . .	6.1	6.0	1.6	1.3	4.6
Starch, etc. (by difference) . .	57.7	59.0	41.8	40.0	46.6
Fibre . . . . .	1.6	13.2	32.3	35.2	16.5
Ash . . . . .	2.6	4.5	12.8	9.3	12.1
Nutrient ratio . . . . .	1 : 3.3	1 : 8.2	1 : 17.5	1 : 8	1 : 6
Food units . . . . .	127	96	52	57	82

The liquorice plant (*Glycyrrhiza glabra*) grows wild in some parts of the north and east coast of Cyprus. Two samples, called Lapithos and Famagusta, from the place of their origin, gave on analyses the following figures respectively: — Moisture 8.4, and 7.7 %; ash 7.8 and 6.0 %, extract on maceration with chloroform water 27.1 and 23.6 %, glycyrrhizin 10.2 and 9.9 %.

**TOBACCO GROWING IN CYPRUS.** — After the British occupation tobacco-growing was abandoned in the island, and the tobacco used imported from Macedonia. Owing to the rises in the price of tobacco of late years its cultivation has recently been taken up again and, in 1917, a yield of 12 000 bales was expected. Since 1914 the Agricultural Department of Cyprus has been undertaking a series of tobacco growing experiments in different parts of the island with the Samsoun, Kavallas, Xanthi and Trebizond varieties. The results improved each year and were entirely satisfactory. About  $\frac{1}{3}$  of the tobacco now produced in Cyprus is made into "Latakia", or fumed tobacco by fumigation for four or five months. This process was introduced into the island by Syrian refugees and with it fermentation, selection of the leaf, etc. require neither great skill nor care, and became of secondary importance. Latakia tobacco exported into England sold well there. A wild plant, elecampane, locally known as "gonisos", grows very abundantly in the island and is well suited to the fumigation process.

**SUNFLOWER STEMS FROM RHODESIA.** — The cultivation of sunflowers for seed production is increasing in Rhodesia. In 1916 it occupied 1 766 acres and yielded 500 tons of seed. It should be possible to extend its cultivation much more and to make an additional profit from the stems. The sample sent to the Imperial Institute for examination consisted of main stems about 6 ft. long,  $1\frac{1}{2}$  to  $1\frac{3}{4}$  in. in diameter at the root and  $\frac{1}{2}$  to  $\frac{3}{4}$  in at the top, containing a firm, white pith with a specific gravity of 0.043. The constituents of the dry pith were:— ash 18.6 %, proteins

3.4 %, fat 1.1 %, fibre 21.8 %. As compared with maize pith it contains much more ash and much less fibre. It might be used as a food for cattle, but it must be remembered that the Division of Chemistry of the United States Department of Agriculture (*Bulletin* No. 50, p. 27) has shown the food value of maize stems to be increased by the removal of the pith, which is the least digestible part and is very absorptive. Sunflower pith contains too little cellulose to be used for the extraction of this product. Its fibre is too short and brittle to replace sola (*Aeschynomene aspera*) pith in the manufacture of sun-helmets. The entire stems yield 37 to 38 % of pulp which gives a fairly good paper which does not, however, bleach well. If the pith is removed from the chopped stem by scraping and winnowing, 36 % of a pulp is obtained which gives a better paper, but also does not bleach well.

The stems examined contained 10.3 % of moisture and 10.7 % of ash of the following composition:—potash 49.6 %, soda 2.3 %, phosphoric acid 1.5 %. The best use to which these stems can be put is to chop them up finely and spread them as manure, since they contain about 5 % of potash, or else to burn them and use the ash as a potassic fertiliser or for the extraction of potash, as is done in Russia.

#### RAFFIA OR BASS: ITS PRODUCTION, PREPARATION AND UTILISATION.

— Raffia or bass, used for tying plants and in grafting is obtained chiefly from *Raphia pedunculata* of Madagascar, which is essentially a coast species. The principal centres of production of the fibre are the provinces of Majunga, Nossy-Bé and Analalava, and the east coast between Tamatave and Vatomandry. The same species also occurs in East Africa. Other palms also yield raffia, but of a quality inferior to that of Madagascar. The most important of these are:—*R. vinifera* (= *R. taedigera*), abundant in many parts of West Africa, *R. Laurentii*, *R. Gentilii*, *R. Munbutorum*, *R. Sese*, which with *R. vinifera* and other species occurs in large numbers in the Belgian Congo, *R. longiflora* of the Ivory Coast, etc.

*R. pedunculata* can be used for the extraction of fibre when about 15 years old and attains its maximum yield when 40 to 50 years old, when fructification begins. The raffia strip consists of the leaf epidermis, which is strongly thickened on the exterior and bands of sclerenchymatous cells immediately beneath it. In *R. pedunculata* these bands of sclerenchyma are separated from one another by one, rarely two, thin-walled parenchymatous cells. A palm gives on the average 10 leaves a year, but as some are left to develop, only an average of 6 is cut, weighing altogether about 225 lb. and yielding 3.22 % of dry raffia, or about 7 ½ lb. a year. Before the war the price of raffia at Tamatave was from £ 18 to £ 24 per metric ton. In 1914, 4 424 metric tons of raffia with a value of £ 97 329 were exported from Madagascar. The raffia trade is also beginning to develop in West Africa and in some parts of East Africa. Raffia is used in Madagascar for the manufacture of relatively fine fabrics (made with the fibre alone or mixed with cotton or silk), of mats known as "rabannas", of hats, etc. In Zanzibar sacks are made of it, in France mats, carpets, baskets, curtains, etc. It dyes easily.

"WILD OLIVE" FRUITS. (*Ximenia americana*) FROM SOUTH AFRICA (1). — This species, widely distributed in tropical Africa, India, Ceylon, Brazil, the West Indies and the tropics generally, has fruit known by different names according to the district in which it is found (wild lime, mountain plum, seaside plum, citron of the sea, etc.). The natives of the various countries and different writers disagree in the properties attributed to it. Some say it is edible (WATT, SCHWEINFURTH), others that it smells of prussic acid and that no animal will touch it, and others (SAFFORD) that it is much relished by a species of dove. There is also much diversity of opinion with respect to the kernels of the fruit which are edible according to some, purgative or poisonous according to others. A sample from South Africa was examined at the Imperial Institute with the following results:— Average weight, of the whole fruit, 1.6 gm., of the kernel, 1.2 gm.; oil yield of the kernel (containing 3.4 % of moisture) 65.6 to 65.8 % (equivalent to 67.9 and 68.1 % from the dry kernels) by extraction with light petroleum and acetone respectively; specific gravity at 15°C., 0.9221 and 0.9220; acid value, 2.1 and 1.6; saponification value 170.4 and 172.7; iodine value, 93.6 and 88.8 %; unsaponifiable matter 2.9 % including 2 % of a rubber-like substance which makes the oil very viscous and makes it uncertain whether it could be used for commercial purposes (lubricating, soap-making, etc.) before technical trials on a large scale have been made. The oil is non-drying. The rubber-like substance does not appear suitable as a rubber substitute. An analysis of the meal gave the following results:— Moisture 6.2 %; crude protein 38.8 % of which 33.4 % were true proteins and 5.4 % other nitrogenous substances; fat 5.3 %; starch, etc. (by difference) 38.1 %; fibre 6.3 %; ash 5.3 %; nutrient ratio 1:1.3; food units 148. It contains no cyanogenetic glucosides. It is very rich in protein, but as feeding trials in Germany did not give very good results, it would be well to make further trials before deciding the question definitely.

THREE NEW OIL SEEDS FROM WEST AFRICA. — These seeds are known as "N'gore nuts" (*Ongokea Gore*), "N'kamba nuts" (*Heisteria* sp.), and "Strephonema kernels" (*Strephonema* sp.). As these species have only been identified botanically by the fruit they are uncertain or incomplete.

The results of analyses of the oils and cakes are given in Table III. The oil of the first species (yield, 70.7 % of the dry kernels) is of a dark colour and has an unpleasant smell. It is viscous, and may be used for lubricating, soap-making, etc.; it is non-drying. The oil of the second species (yield, 16.3 % of the dry kernels) is non-drying and could be used for various industrial purposes. The fat of the third species (yield, 41.8 % of the dry kernels) melts at 29°C., contains 6.9 % of glycerin, and has a neutralisation value of fatty acids of 183.2. None of the meals contain alkaloids or cyanogenetic glucosides, but that of N'kamba nuts appears to contain saponin and that of Strephonema kernels a considerable quantity of tannin (a sample contained 7.3 % of moisture, 44.3 % of matter insoluble in water, 17.7 % of non-tannin extractive matter, 30.7 % of tannin,

(1) See also R. Sep., 1918, No. 985. (Ed.).

3.3 % of ash, tintometer readings for a 0.5 % tannin solution in a 1 cm. cell, red 7.4, yellow 15.9). It seems unlikely that this meal may be used as a tanning material or for the manufacture of tanning extract, but the extract, which is dark purple-red, would give a dark-coloured leather.

TABLE II. — *Properties of the three oils and the meals corresponding to them.*

	N'gore Nuts	N'kamba Nuts	Strephonema Kernels
<i>Oils :</i>			
Specific weight at 15°C . . . . .	0.987	0.931	0.8596
Solidifying point of fatty acids . . . . .	< 8°C	17°C	57°C
Acid value . . . . .	17.7	26.1	8.0
Saponification value . . . . .	190	194.8	181.1
Iodine value . . . . .	153 %	93.2 %	67.0 %
Hehner value . . . . .	83 approx.	94.5	—
Insoluble fatty acids . . . . .	80.2 %	93.4 %	—
Unsaponifiable matter . . . . .	2.8 "	1.1 "	—
Volatile acids, soluble . . . . .	1.0	2.05	0.9
Volatile acids, insoluble . . . . .	12 approx.	0.95	0.2
Acetyl value . . . . .	85.5	—	—
<i>Meals :</i>			
Moisture . . . . .	6.8 %	6.2 %	7.3 %
Crude protein . . . . .	43.4 "	18.9 "	9.5 "
Consisting of: true proteins . . . . .	37.6 %	15.5 %	8.2 %
Other nitrogenous substances . . . . .	5.8 "	3.4 "	1.3 "
Fat . . . . .	7.0 %	1.3 %	0.9 %
Starch, etc. (by difference) . . . . .	26.9 "	68.4 "	69.9 "
Fibre . . . . .	8.8 "	2.4 "	9.1 "
Ash . . . . .	7.1 "	2.8 "	3.3 "
Nutrient ratio . . . . .	1 : 1	1 : 3.8	—
Food units . . . . .	153	119	—

INDIAN TRADE IN OIL SEEDS. — The annual production of oil seeds in India is well over 5 million tons of a value exceeding £ 50 000 000. The paper under review is divided into two parts, one which treats of the trade generally, and one dealing in detail with each seed, its oil and by-products, namely :— cotton, linseed, niger seed (*Quizotia abyssinica*), rape (*Brassica campestris*), Indian rape (*Eruca sativa*), mustard, poppy, ground nuts, sesame, castor seed, mowra, mahua or mowa (*Bassia latifolia*, *B. longifolia*, *B. butyracea*), copra, and coconut oil. A table gives the world's trade in these oils and the Indian exports for 1913-14, and their importation into the chief countries consuming them.

A POSSIBLE NEW SOURCE OF THYMOL. — Before the war thymol was obtained commercially only from ajowan oil, distilled from ajowan seeds (*Carum copticum*) which were exported for this purpose from India to Germany.

Among the plants considered as a possible source of thymol is *Ocimum*

*viride*, a native of West Africa which has been introduced into India, Cyprus, and the West Indies. In the wild state this plant reaches a height of 3 ft. to 6 ft., and is perennial. It is sometimes known as "mosquito plant" because it is supposed to keep these insects away. Several samples of *O. viride* leaves from Nigeria and Sierra Leone were examined at the Imperial Institute and, on distillation 0.35 to 1.2 % of essential oil containing 32 to 65 % of thymol was obtained. The Institute obtained seed of this species from Sierra Leone and distributed it in Seychelles, Cyprus and the East Africa Protectorate. The plant did well in Seychelles, and two samples of oil distilled locally were examined at the Imperial Institute. Leaves from four month old plants which had just started flowering gave, on distillation, 0.5 % of oil. Four months later the bushes were 6 ft. high. By distilling the upper 8 in. of the shoots 0.45 % of oil was obtained. The total yield of oil was nearly 3 ½ tons per acre. Five or six cuttings a year may be made. The two oils, from the leaves and the stems respectively, had the following properties:— specific gravity at 15° C., 0.942 and 0.924; optical rotation  $\alpha_D + 105'$  and  $+ 0.60^\circ$ ; phenols, 62 % and 52 %; solubility in alcohol, soluble in 3.1 vols. of 70 % alcohol at 15° C. and insoluble in 20 or less vols. of 70 % alcohol, but soluble in 1.4 vols. of 80 % alcohol at 15° C. The phenols in both oils seem to consist entirely of thymol.

INDIAN HENBANE (*Hyoscyamus muticus*). — This plant is now the chief source of atropine, and is obtained commercially from Egypt and the Soudan. The species also occurs commonly in India. A sample from India examined at the Imperial Institute a few years ago contained only 0.1 % of total alkaloid, much less than is found in the Egyptian plants. A sample of Indian henbane (probably *H. muticus*) examined by BARNES in 1916 contained 0.827 % of mydriatic alkaloids. A specimen grown at the Koilpatti Agricultural Station, Madras, and examined by the Imperial Institute in 1916 yielded 0.61 % of total alkaloids (equivalent to 0.66 % of the dry material) which crystallised easily and consisted of hyoscyamine. The results of this cultivation test were, therefore, satisfactory.

BAOBAB WOOD AND BARK FROM SOUTH AFRICA. — Baobab (*Adansonia digitata*) occurs frequently in tropical Africa and India, and has been introduced into the West Indies. The fibre, extracted from the inner bark, is used by the natives for making ropes and sacking, and small quantities are occasionally sent to England from the West Indies for use in the manufacture of paper. The Imperial Institute examined samples sent from South Africa in 1917 to ascertain their value for paper-making. The air-dried wood contained 10.2 % of moisture and 52.5 % of cellulose. The fibres were 0.7 to 3.2 mm. long, but mostly from 1.5 to 2.5 mm. On boiling with caustic soda 48 to 50 % of dry pulp were obtained. The air-dried bark, contained 9.2 % of moisture and 44 % of cellulose. The fibre was from 1.0 to 4.6 mm. long, but mostly 1.7 to 2.4 mm. Boiling it with caustic soda gave 27 % of dry pulp. From the inner bark alone was obtained 33 % of excellent quality pulp which, however, did not bleach satisfactorily. On the other hand, if the whole bark is used the pulp contains sclerenchymatous cells which are not removed by washing and make the



pulp gritty and too hard to be used. The pulp from the wood is less good than that from the inner bark and is less satisfactory for paper-making. Owing to the lightness and bulkiness of the wood it would have to be made into pulp in the countries producing it.

1076 - **Australian Interstate Conference of Agricultural Scientists.** — In *The Journal of the Department of Agriculture of South Australia*, Vol. XXI, No. 5, pp. 388-396. Adelaide, 1917.

AGRICULTURAL  
SHOWS  
AND  
CONGRESSES

A Conference attended by agricultural scientists from all the Australian States convened by the Federal Government at the instance of the Advisory Council of Science and Industry, was held in Melbourne from November 9th to November 16th, 1917. A number of papers dealing with different aspects of agricultural science were read and discussed. The following resolutions were carried by the Conference and forwarded to the Executive Committee of the Advisory Council of Science and Industry of the Commonwealth of Australia.

I. — That a "Seed Improvement Committee" be formed, which should, among other matters, deal with: — a) The nomenclature of cultivated varieties of farm crops; b) the elimination of undesirable varieties of crops; c) the exchange and dissemination of seed samples for research work; d) the recommendation of money grants to approved State or other Institutions for work in connection with seed improvement and the introduction of improved varieties of crops.

II. — That in view of the benefits to be derived from the systematic introduction of seeds and plants into the Commonwealth and to ensure more economy of effort in this direction on the part of all the States, this Conference is of the opinion that as soon as practicable a Plant Introduction Bureau should be established, the functions of which would include: — 1) Arrangements for the introduction of new and useful agricultural plants from other countries into the Commonwealth; 2) the systematic testing of these introduced plants in cooperation with State Experiment Farms; 3) the systematic recording of the results of such tests.

III. — That each State Department of Agriculture should continue or initiate the work of improvement and selection of its cultivated crops as part of its regular work, and that such work of improvement be on uniform lines in all the States.

IV. — That the rust in cereals, particularly black rust in wheat, which is common in all the States, and in some seasons largely reduces the yields, be made the subject of a special investigation in connection with plant-breeding.

V. — That the Executive Committee of the Advisory Council be asked to arrange for an annual meeting of plant-breeders from the different States, with a view to co-ordinating their work and arriving at a uniform policy without interfering with individual methods. The meeting to be fixed at a convenient season of the year (July).

VI. — That an organisation should be established to deal with the collection, propagation, improvement, and cultivation in suitable areas of the most promising indigenous grasses and fodder plants.

VII. — That it is advisable to closely investigate the tobacco industry in Australia, both in the interests of the producer and with a view to retaining locally the profits of manufacture.

VIII. — That in view of the high prices ruling for fibre products and the desirability of making Australia self-contained in the production of fibre, a thorough investigation be made into the possibilities of fibre cultivation in Australia, particularly flax and sisal hemp, and the possibilities of producing these fibres for local manufacture or for export.

IX. — That the Advisory Council of Science and Industry be asked to ascertain whether the British Government would be prepared to purchase dew-retted flax fibre from Australia in 1919, and if so, what quantities and at what price f. o. b.

X. — The Conference is of opinion that the prospect of commercial production of power alcohol from certain crops is promising, and suggests that special experiments should be arranged by the Advisory Council of Science and Industry to determine the actual yields of alcohol obtainable from these crops, including sorghums in various stages of development.

XI. — That the Conference welcomes the proposal of the advisory Council to investigate the utilisation of Australian phosphates, and suggests that this investigation should include manurial trials, particularly on pasture lands in those of the States which possess such phosphates.

XII. — That in view of the need for a supply of scientific investigators into agricultural and pastoral problems the Advisory Council of Science and Industry be requested to direct the attention of the various Australian Universities to the subject.

XIII. — In view of the prominent position occupied by the United States of America in scientific and practical agriculture, and of the similarity of the climatic and economic conditions of that country to those of Australia, this Conference recommends the early appointment of a permanent agricultural representative from Australia to the United States, whose duties should include keeping Australia in touch with improved scientific and practical methods in agriculture and the supply of promising varieties of cereals and other crops.

XIV. — That the Conference expresses its appreciation of the action of the Executive Committee of the Advisory Council of Science and Industry in calling it together, and is confident that the opportunity of meeting and consulting together thus afforded to agricultural scientists from the different States will be beneficial to agricultural progress in Australia.

## CROPS AND CULTIVATION.

### AGRICULTURAL METEOROLOGY

1077 — Investigations into the General Movements of the Atmosphere. — GARRIGOU-LAGRANGE, P., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 170-172. Paris, 1918.

The general movements of the atmosphere affect, during periods of greater or lesser length and in well-marked directions, whole zones of the hemisphere. In every season the general circulation is characterised by

areas of high and low pressure, registered at the Signal Office of Washington. As a result of the general movement in question these are subjected to transformations and displacements which rise or fall. The resulting effects in each district are noted on the charts of the various meteorological stations. Unfortunately the complexity and duration of the phenomenon make it very hard to understand, and to recognise it is necessary to examine a long series of charts. To make this easier the author has evolved an original method of examination. Each chart is considered as an instantaneous photo of the phenomenon, and the charts are joined to each other by the requisite number of intermediate conditions. When reproduced on a cinematograph film and projected, these series of charts give the impression of a fairly rapid movement, the different phases of which can be easily distinguished. It has thus been possible to prove :— 1) that the low and high pressures (at the surface of Europe and North America) follow a trajectory, sometimes to the north on the 60th parallel, sometimes to the south on the 30th, so that, in a given region, the atmosphere is subjected to a sort of respiration as a result of the alternate rise and fall of this trajectory ; 2) that the displacements of the trajectory, involving, at the time of falls, the formation of elongated isobars which precede the gusts, make it possible to determine exactly the periods when these are to be feared ; 3) that these phenomena are reproduced in accordance with a fairly well-defined law of periodicity.

The study analysed has shown astronomical relations similar to those shown by POINCARÉ in his study on the displacement of the field of the trade-winds. Both above and below the 30th parallel, the action of the moon usually draws with it, in aggregate movements, vast areas of the hemisphere. Thus, by the help of this periodicity it is possible to connect with the movements of the moon (chiefly in declination) the general movements of the atmosphere and, in each region, the displacement of the trajectory from the centre of depression. If the movements on a given meridian and those near it are known it is also possible to deduct the probable succession of the phenomena during one day, and to state, for example, that during that period the centres of depression will tend to pass to the north of the point of observation, that this movement will be more marked towards the evening, etc.

1078 — **The Effect of Weather on the Yields of Potatoes, Wheat and Maize, in Ohio, U. S. A.** — WARREN SMITH, J., in the *Monthly Weather Review*, Vol. XLII, No. 2, pp. 78-87 + 15 Figs.; Vol. XLIII, No. 5, pp. 222-236 + 23 Figs.; Vol. XLIV, No. 2, pp. 74-75. Washington, February, 1914; May, 1915; February, 1916.

The author has made use of the abundant meteorological and agromonomical statistical data collected by the Weather Bureau, Bureau of Statistics and Bureau of Crop Estimates of the U. S. Department of Agriculture to investigate the influence of weather on the distribution and yields of potatoes, winter wheat, and maize in the State of Ohio.

I. — **POTATOES.** — The most important weather factor for this plant is *normal temperature* during July ; if it exceeds normal the yield will be much below average. The coefficient of negative correlation is very high :

$r = -0.51$  (1). When  $r$  is calculated for the other months or groups of months the values obtained are always negative, but less high than those for July. They are: — May,  $-0.10$ ; June,  $-0.22$ ; July,  $-0.51$ ; August,  $-0.31$ ; September,  $-0.21$ ; October,  $-0.11$ ; June and July combined,  $-0.50$ ; July and August combined,  $-0.050$ ; June, July and August combined,  $-0.49$ .

The effect of the rainfall is much less marked than that of temperature. Only July and August combined have a positive and fairly marked correlation coefficient,  $0.33$  and  $0.37$  respectively, values 4 and 5 times that of the probable error. Thus, for a good potato harvest in Ohio, July should be cool and damp.

A closer examination of data for the counties of Franklin, Madison, and Pickaway, based on meteorological values for periods of ten days as well as for those of one month, not only confirmed the statements made with respect to the whole of Ohio, but showed yet more clearly the special importance of the first ten days of July. The correlation coefficient between the yield of potatoes and the temperature during these ten days was  $0.4$ , much above that of the other ten day periods.

It is important to know at what stage the plant is particularly sensitive or exacting with respect to the weather factors, in other words, to determine the critical stage of the potato with regard to temperature and moisture (2). For this purpose the phenological and meteorological observations made by Mr. T. MCKESSELL at Wauseon (Fulton County, Ohio) from 1883 to 1912, proved exceedingly useful. The vegetative period of the potato is subdivided into three sub-periods:— 1) from planting to the appearance above ground; 2) from the appearance above ground to flowering; 3) from flowering to ripening. For these three sub-periods and for the two ten-day periods, before and after flowering the following correlation coefficients between yield and rainfall on the one hand and yield and temperature on the other were found:—

1) *From planting to appearance above ground*:— rainfall  $-0.06$ , temperature  $+0.03$ .

2) *From appearance, above ground to flowering*:— rainfall  $+0.33$ , temperature  $+0.24$ .

3) *From flowering to ripening*:— rainfall  $+0.18$ , temperature  $+0.16$ .

4) *Ten days before ripening*:— rainfall  $+0.09$ , temperature  $+0.17$ .

5) *Ten days after ripening*:— rainfall  $-0.07$ , temperature  $-0.30$ .

For the rainfall the maximum value of  $r$  ( $0.33$ ) occurs between the appearance of the shoot above ground and flowering, and is positive.

(1) To calculate the correlation coefficient  $r$ , the formula used is  $r = \frac{\sum \sigma \sigma'}{\sqrt{\sum \sigma^2 \sum \sigma'^2}}$ , where

$\sigma$  represents the deviation from the mean precipitation or temperature and  $\sigma'$  the deviation from the mean yield in grain. By these means are obtained, for  $r$ , values between  $+1$  (perfect positive correlation) and  $-1$  (perfect negative correlation). Values above  $+0.5$  or below  $-0.5$ , therefore show a high correlation coefficient. (Ed.)

(2) See R. March, 1918, No. 256. (Ed.)

For the temperature the maximum value of  $r$  ( $-0.30$ ) occurs during the same period and is negative.

Even without possessing phenological data it may be assumed that the first ten days of July, or any other ten-day period in which a high negative correlation coefficient is found for the various counties of Ohio, correspond to the ten-day period immediately following the flowering stage.

II. — WINTER WHEAT. — For this plant the temperature of March is the most important factor. When this temperature exceeds the normal the probability of the yield being above the average is 94 %, but when the temperature is below the normal this probability drops to 25 %. To obtain a good wheat harvest in Ohio, March should be rather warm. Contrary to the general opinion, snowfalls during this month are always detrimental to wheat.

III. — MAIZE. — The dominant factor for maize is rain in July, with a positive correlation coefficient of 0.59. When, during this month, the rainfall is 1 in. above the normal, the probability of a yield superior to the average is 92 %, but if the rainfall is below the normal, this probability is only 13 %.

The average yield per acre for all the years when the rainfall in July was less than 3 in. was 30.3 bushels, but when the rainfall in this month was 5 in. or more the average yield was 38.1 bushels per acre.

A closer examination of averages of ten-day periods as well as of one month showed the importance of certain ten-day periods. Thus, in the county of Wayno, the highest positive correlation coefficient between rainfall and yield occurs during the second ten-day period of July and equals 0.71; in the counties of Franklin, Madison, and Pickaway (central Ohio) it is 0.52 and occurs during the first ten days of August, etc.

By phenological and meteorological observations at Wauseon, it was possible to determine for maize, as for the potato, the date of the critical stage with respect to weather. Below are the correlation coefficients found between yield and rainfall and yield and temperature respectively for the sub-periods considered above, the ten days before planting and the ten days before and after flowering: —

- 1) Ten days before planting: — rainfall,  $+0.01$ ; temperature,  $-0.03$ .
- 2) From planting to appearance above ground: — rainfall,  $-0.06$ ; temperature,  $-0.03$ .
- 3) From appearance above ground to flowering: — rainfall,  $-0.03$ ; temperature,  $+0.18$ .
- 4) From flowering to ripening: — rainfall,  $+0.29$ ; temperature,  $+0.08$ .
- 5) Ten days before flowering: — rainfall,  $+0.20$ ; temperature,  $-0.003$ .
- 6) Ten days after flowering: — rainfall,  $+0.74$ ; temperature,  $-0.28$ .

The critical period for rain is, therefore, the ten days following flowering, and the correlation coefficient,  $+0.74$ , is very high.

The effect of temperature is much less marked and only during the

ten days after flowering is a value exceeding the probable error found for the correlation coefficient. At this period high temperatures are detrimental to maize.

To sum up, to obtain a good maize harvest in Ohio abundant rain and moderate temperatures are necessary during the ten days following flowering.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

1079 - **The Reserves of Soil Water During Drought.** — DUMONT, J., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 7, pp. 278-280 + 2 Tables. Paris, 1918.

In July, in the experiment field of the Agricultural Station at Grignon, in plots containing both fertilised and unfertilised cereals and beets, the author estimated the reserves of soil water at various depths between the surface and 80 cm. (31.44 inches). He proved that, besides the influence due to the difference in crops, there was also clearly another one due to the fertiliser. Thus taking as a basis for calculation the average percentage of moisture and the weight of the layer of soil of 1 hectare (2.47 acres), the total aqueous reserves are:— 1560 metric tons in the unfertilised beet plot; 1536 tons in the fertilised beet plot; 900-1000 tons in the fertilised cereal (wheat and oats) plot. Fertiliser applied in large quantities and ploughed in maintains a high proportion of moisture (17.8 %) in the soil layer. The average percentage of moisture for the three fertilised plots (beets, wheat, oats) was 15.8, whereas for the unfertilised plot (beets) it was only 10.4.

In spite of the importance of the reserve water in the lower layers of the soil, it is above all the superficial distribution of these reserves that influences the progress of vegetation at the beginning and, consequently, the whole progress of the crop. Once the root system is sufficiently developed the plant's supply of water is more assured and it is then better able to protect itself against drought. Attention is drawn to the fact, confirmed by observations made over a long period, that, even after a prolonged drought, there is still relatively abundant water in the soil; for example, in 1913, after a long drought, the quantities varied from 720 to 960 metric tons per hectare at a depth of 50 cm. (19.65 inches).

1080 - **Effect of Irrigation Water and Manure on the Nitrates and Total Soluble Salts of the Soil.** — HARRIS, F. S. and BUTT, N. I. (Utah Agricultural Experiment Station), in *Journal of Agricultural Research*, Vol. VII, No. 9, pp. 333-359, + 7 Tables, + 18 Fig., + Bibliography of 17 Publications. Washington, D. C., February 26, 1917.

There is no method available for measuring exactly what portion of the plant food in the soil can be taken up by crops at any given time; the nearest approach is to extract the soil with some solvent and to determine the quantity of plant food in the solution obtained.

In the present paper an attempt has been made to determine the effect of varying quantities of soil moisture and manure on the total soluble salts and nitrates that can be extracted by water from the soil. Some of the soils under investigation were kept in the laboratory, others were allowed to stand for long periods in large tanks, while still others were studied under normal field conditions. Comparisons were also made of cropped with uncropped soils in tanks and in the field. The results are given below.

[1915-1920]

With a sod soil held in the laboratory for 2 ½ years, the total salts and nitrates accumulated most rapidly with a moisture content between 23 and 28 per cent.

Cropped and uncropped soil kept in large tanks under controlled moisture conditions showed a decrease in nitrates and total soluble salts as the percentage of moisture increased, the nitrates being particularly low in water-logged soil.

Under field conditions more nitrates were found in both cropped and fallow soils during the summer than just after the corn crop was harvested.

The nitrates of the fallow field soils averaged higher with a manuring of either 5 or 15 tons to the acre than with no manure, but on the cropped soil, although the 15-ton application of manure resulted in more nitrates than no manure, the 5-ton did not. The fallow soil showed the effect of the manure on the nitrates more in the top 2 or 3 feet than at lower depths.

The highest soluble-salt content of fallow soil was on plots manured at the rate of 5 tons to the acre; the lowest was on plots receiving 15 tons. The corresponding high and low points in cropped soil were on plots receiving no manure and 5 tons to the acre, respectively.

Unirrigated land contained more nitrates than irrigated on both cropped and uncropped plots. Increasing the irrigation water applied to the soil decreased its nitrate content. The total soluble salts in cropped plots decreased as the water applied increased and in fallow soil an application of 40 inches of water resulted in less salts than where no irrigation water was added. The treatment affected the salts more in the surface foot than at greater depths with small irrigations, but when 20 inches of water or more were applied some of the salts seemed to have moved below 10 feet in depth. Large irrigations decreased the soluble salts in cropped more rapidly than it did in fallow soils.

Manuring or irrigating the soil affected the nitrates relatively more than the total salts.

In unmanured soil the nitrate content was about twice as great with a fallow as with a crop, and in manured, it was about three times as great.

The ratio of total soluble salts to the quantity of sodium nitrate found in a cropped soil rose from 24.5 to 1 without irrigation to 37.5 to 1 when 40 inches of water were used. The ratio in fallow soil increased from 8.9 to 1 with no irrigation water to 16.2 to 1 with 40 inches.

The field results do not indicate a close relationship between the crop yield and the total soluble salt or the nitrate content of the soil if the differences between cropped and fallow soils indicate the amounts of these substances which the crop used.

After a consideration of both pot and field experiments, it is evident that the soluble salts and especially the nitrates are found in lower concentrations in soils receiving large quantities of irrigation water than in those receiving less water. This is probably due in part to the leaching action of the heavy irrigations as well as to the lower nitrification in the presence of excessive soil moisture.

1081 - **Evaporation from the Surfaces of Water and River-Bed Materials.** — SLEIGHT, R. B. (Assistant Irrigation Engineer, U. S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No 5, pp 209-261 + 26 Tables + 13 Figs. + 6 Plates + Bibliography of 27 Publications Washington, July 30, 1917

The Irrigation Field Laboratory at Denver, Colorado, where the author carried out his investigations, was established for the purpose of studying, from an engineering point of view, the problems connected with the utilisation of water for irrigation. The laboratory is of such a size and type that natural phenomena may be observed under conditions rather less artificial than is usual in laboratories.

The first investigations made there bore on the action of water and the movement of water through soils. Evaporation plays a large part in the apparent efficiency of the use of irrigation water. As the measurements and data available on evaporation were not considered sufficient for the proposed work, research on this subject was undertaken. The work done in 1916 was confined to the study of evaporation, divided into two parts: — 1) evaporation from water surfaces; 2) evaporation from the surfaces of river-bed materials.

I. — **EVAPORATION FROM WATER SURFACES.** — The following points were studied: — a) variation in the speed of evaporation from pans of varying sizes; b) variation in the speed of evaporation from pans of varying depths; c) comparison between the rate of evaporation of flowing and of still water; d) comparison of the results obtained from different types of so-called standard evaporation pans; e) comparison between the rate of evaporation from round pans and from square pans; f) application of the results obtained with experimental pans to larger water surfaces.

The results are presented, not as formulae which may easily be misinterpreted and applied in cases where their use is not justified, but as graphs based on the original data (given in tables) which show clearly the limits within which these data may be applied, or as coefficients obtained from these graphs. The principal deductions are:—

a) In metal pans from 1 to 12 ft. in diameter sunk in the soil the water surface evaporated during 1 year was from 76.18 to 49.16 inches, or from 154.9 to 100 %. The small tanks had higher day temperatures and lower night temperatures than the bigger ones; the average daily temperatures are almost equal. The effect of the higher day temperatures, however, is greater than that of the lower night temperatures, and results in greater evaporation. For a given wind velocity the air on the surface of a small pan is renewed more often than that on the surface of a large one in the ratio *large diameter : small diameter*, thus increasing the rate of evaporation in the *small pan*.

A study made at Salton Sea by Mr. BIGELOW to determine the law of evaporation by the use of cylindrical pans *with vertical sides almost entirely above the soil* (at Denver they were sunk in the soil) of diameters of from 1 to 12 ft., gave data concerning the rate of evaporation which do not agree with those obtained by the author at Denver, and do not appear to be applicable to large water surfaces.

b) Evaporation was observed in pans of equal diameter but of depths



varying from 0.25 ft. to 5.75 ft. and the results for each group expressed in percentages of the deepest pan. It was found that during the hot season the rate of evaporation is greater in the shallow pans, but that in the cool season the opposite holds good. The differences are due to the temperature of the water and are not very large, but for general use, a tank not less than 2 ft. deep is recommended, as its contents do not become hot or cold so rapidly as those of a shallower tank.

In two tanks containing water of equal depth and with equal exposed area but still in one case and, in the other, kept flowing by a centrifugal pump, it was found, after differences due to temperature had been corrected, that evaporation was greater in the tank with flowing water.

In one set of experiments the difference was due to the evaporation in still water multiplied by 1.072 and, in the other, by 1.086. Although this experiment was limited by the unavoidable low velocity of the water it shows that evaporation from a canal is slightly greater than from still water under exactly the same conditions of exposure, temperature, etc. There does not appear to be any definite relation between evaporation and velocity within the limits of the experiment. To the author's knowledge only one previous experiment has been made on this subject. It was carried out in Spain in 1849 for a short period only and the agitated water evaporated 140 % as compared with the still water. Corrections for differences in temperature do not seem to have been made.

d) The evaporation from a standard pan used at the Class A stations of the U. S. Weather Bureau when above the ground, was  $1\frac{1}{2}$  times as great as that from a cylindrical tank 12 ft. in diameter and 3 ft. in depth set 2.75 ft. in the ground.

The evaporation from a PICHE evaporimeter was 181.7 times that of the same tank.

The data obtained with the standard pan are, therefore, not applicable to large water surfaces; this is true to a yet greater extent of those obtained with the PICHE evaporimeter.

e) Experiments were made with two pairs of pans, one circular, the other square, of equal exposed water surface (9.0 sq. ft. in one case and 3.14 sq. ft. in the other), all 3 ft. deep and set in the ground. Taking the mean weekly averages for 1 year, the large square pan evaporated 104.7 % and the small square pan 104.9 % as compared with the circular pan of equal area. This increase in evaporation is due to the fact that, for the square tank, the ratio *perimeter : area* is greater than in the circular tank. No difference was observed between the mean temperatures of the water in the two types.

f) The evaporation from a lake of 17 acres having no outlet, when measured with a floating pan was found to be 108.9 % that of a 12 ft. pan and 86.1 % that of a 3 ft. square pan (*i. e.* equal in area to the floating pan). From comparative investigations made partly with U. S. Geological Survey floating pans and partly with pans of other sizes, the author draws the following conclusions:—

1) Evaporation figures obtained with tanks of a depth of 2 ft. or

more, preferably circular, set in the ground so that a metal rim not exceeding 3 in. projects, and in which the water is kept approximately at the ground level, are the most suitable for use with large open water surfaces.

2) Data obtained with such tanks may be applied suitably to large open water surfaces under the same conditions of wind, atmospheric temperature and moisture, by multiplying the evaporation depth (*i. e.* the depth of water evaporated in a unit of time) of a 2 ft. tank by 0.77 and of tanks of 4, 6, 9 and 12 ft. by 0.84, 0.90, 0.98 and 0.99 respectively. Data obtained with a 3 ft. cubic tank sunk 2.75 ft. in the ground (Fort Collins type) should be multiplied by 0.80, those obtained with a U. S. Geological Survey floating standard, by 0.91, and those obtained with the type used in the Class A stations of the U. S. Weather Bureau, by 0.66.

These results only agree in part with those previously obtained, but no other work has gone so deeply into the subject.

## II. — EVAPORATION FROM THE SURFACE OF RIVER-BED MATERIALS —

*Experimental methods:* — Typical river-bed material was placed in watertight tanks, the surface of the water kept at a fixed level below the surface of the material, and the loss by evaporation measured and expressed in percentage of the loss suffered by a water surface of equal shape and size.

*Results.* — The results are given in tables and diagrams. Among the data obtained are the following: — for a water table 3 in. below the surface of the bed, evaporation varied, according to the material, from 66 to 89 %; for water tables 6, 12, 16 and 24 in. below the surface, evaporation varied from 53.0 to 86.6 %, 24.2 to 82.5 %, 42.0 to 79.8 %, and 11.2 to 68.0 % respectively (for the two determinations only two kinds of material were used, for the others, five).

Unpublished data obtained in 1915 by Mr. DIESEM at North Platte furnish a positive control of those obtained by the author.

1082 — *Irrigation of Alfalfa in Imperial Valley, California* (1). — FACKARD, W. C., in the *University of California Publications; College of Agriculture, Agricultural Experiment Station Bulletin* No. 284, pp. 67-84 + 5 Figs. + 5 Diagrams. Berkeley, California, September, 1917.

Recent investigations have shown the desirability of modifying the methods of irrigating alfalfa in the Imperial Valley so as to increase the yields. The bulletin under consideration describes investigations into the development of the roots in various types of soil with different quantities of water to determine the effect of irrigation on the roots. For this purpose the alfalfa roots were removed from a plot 3 ft. square, washed, air-dried, and weighed.

It was found that from 80 to 90 % of the fine roots develop in the upper 4 ft. of the soil, where the land receives frequent surface irrigation. Abundant irrigation favours the development of roots to a depth of 5 ft., but, under ordinary conditions, most of the fine roots develop in the upper stratum. Under the experimental conditions most of the fine roots developed in the first 2 ft., showing that special attention should be paid to the upper stratum no matter what system of irrigation is adopted.

(1) For the irrigation of alfalfa in the Sacramento Valley, California, see R., May, 1918, No. 507. (Ed.)

The presence of organic matter has a marked effect on the development of the feeding roots; this was observed each time the roots met a layer containing much organic matter. The larger roots often pass through a sandy stratum containing little organic matter without developing many rootlets till they reach a richer sub-soil. The soils of the Imperial Valley require much organic matter, and this need should be met wherever possible. The two above facts are clearly illustrated by diagrams.

It was also observed that if the water table rises to more than 4 ft. from the surface the roots rot if immersed in the water for a long time (2 to 3 months). If the water table drops new rootlets develop from the healthy part of the plant which has not been destroyed by the water. If the water level rises to 3 ft. from the surface all but the more resistant plants are killed. To obtain satisfactory yields of alfalfa a large amount of water must be supplied frequently during the season so as to prevent drying of the surface soil on one hand and water-logging of the soil on the other. This may be accomplished by adapting the grade of the land, the frequency of irrigation, the size of the field and the head of water used to the type of soil to be cultivated.

In sandy soil the lands for irrigation should not exceed  $\frac{1}{8}$  mile in length and 25 to 30 ft. in width. If the soil is very sandy the lands should be narrow and short and a large head of water should be used to assure quick irrigation. The great danger lies in the application of too much water, especially if the soil is sand overlaying clay, as in this case a high water table is formed.

Medium soils are easily irrigated. If the alfalfa does not do well the soil should be examined with a augur or a spade. If the top soil appears dry before irrigation it is well to give a slight additional irrigation between cuttings, but if the lower strata be saturated the recommendations given for compact or clay soils should be followed.

In compact soils the problem is to let the water pass deep into the soil in sufficient quantity to maintain rapid growth. In such soils, the sub-soil is frequently found to be dry at a depth of from 2  $\frac{1}{2}$  to 3 ft. To obtain proper penetration it is advisable:— 1) to make the lands  $\frac{1}{8}$  to  $\frac{1}{4}$  mile long; on comparatively flat land the borders should be from 50 to 100 ft. apart, but when the land is at all steep they should be only 25 to 30 ft. wide; 2) to run a comparatively small head for a long time. Fields yielding from 2  $\frac{1}{2}$  to 3 tons per acre per year have produced double the quantity with this system of irrigation. In this way also the water penetrates to 5 or 6 ft. when a larger head of water will only penetrate to 3 ft. The grade should not be more than about 10 %. The lower ends should be drained to prevent accumulation of water.

**1083 - Drainage Instruction and Demonstration in Canada.**— I. MITCHELL, J. W. (Supervisor under the Agricultural Instruction Act in the Maritime Provinces). — II. SAVOIE F. N. (Secretary, Department of Agriculture). — III. SCOTT, W. H. (Director of Drainage Demonstrations, Ontario Agricultural College). — IV. ENGLISH, H. O. 'Crop and Soil Instructor', in *The Agricultural Gazette of Canada*, Vol. V, No 7, pp. 680-683. Ottawa, July, 1918.

I. — THE MARITIME PROVINCES. — In Nova Scotia drainage work

is done by the province, which uses a Buckage traction ditching machine. The work is done at the request of the farmers, on plans drawn up by the Drainage Service, and is paid on a commercial basis.

The province of New Brunswick owns a ditching machine and from July to October, 1917, dug 1 435 rods to an average depth of 2 ½ ft. The official price per rod was 30 cents, including the laying of the tile, and did not nearly pay the actual cost.

There is much drainage work to be done in all parts of Prince Edward Island. Last year the Department of Agriculture bought a ditching machine which has proved very satisfactory. In each case the drainage plans are drawn up by the Department.

II. — PROVINCE OF QUEBEC. — Drainage is encouraged by the Department of Agriculture of the province which draws up the plans and executes the work. The surveys are made by six instructors who, in 1917, visited 79 farms and made plans for draining 2 154 acres. The province has bought two Buckage ditching machines. No charge is made for work done on 5 acres or less, but the farmer pays for the board of the conductor and his assistant; for 5 to 20 acres the farmer pays the salary of the conductor as well as the board of the two men. Twenty acres are the maximum area which may be covered for any farmer.

In 1917, 12 963 ft. of drainage were dug. This amount was below the average because of the unfavourable season and the difficulty of replacing broken parts. In the future the Minister of Agriculture for Quebec will make grants to groups of farmers or to Associations to enable them to buy ditching machines.

III. — ONTARIO. — In order to increase the knowledge of drainage the Ontario Agricultural College prepared a cinematograph film illustrating different drainage operations. The province has two ditching machines as well as concrete tile making machines, which are placed at the disposal of farmers for their drainage work on payment of a nominal fee to cover some of the expenses incurred.

IV. — BRITISH COLUMBIA. — In 1917 the Department of Agriculture of this province bought an 8-horse Cyclone ditcher. According to the tests made this machine is not suitable for digging ditches at a depth exceeding 2 ft.

TILLAGE AND  
METHODS OF  
CULTIVATION

1084 - **Dry Farm Crop Rotations and Cultural Methods, in U. S. A.** — ATKINSON, A., STEPHENS, J. M. and MORGAN, G. W., in the *University of Montana Agricultural Experiment Station, Bulletin No. 116*, pp. 54 + 19 Tables + 6 Figs. Bozeman, Montana, March, 1917.

This bulletin gives the results of experiments on crop-rotations suitable to dry farming carried out by the Montana Experiment Station in co-operation with the Bureau of Plant Industry of the U. S. Department of Agriculture. The experiments were made at the Judith Basin Sub-station and the Huntley Experiment Farm.

The average annual rainfall at Judith Basin during the last 18 years was 16.66 in., 10.90 of which fell between April 1 and September 30. The average annual rainfall at Huntley was 13.74 in., 8.42 of which fell

between April 1 and September 30. At both stations the heaviest average rainfall occurs in May and June. The total evaporation from April to August inclusively amounted to an average of 25.049 in. at Judith Basin during the last 8 years and 20.397 in. at Huntley during the last 4 years.

The average temperature from April to September inclusively is 54.8° F. at Judith Basin and 59.7° F. at Huntley. The greatest deviation from the ordinary monthly average occurs in June at both stations.

The experiments were conducted on the same basis at the two stations, the normal principal crops being cultivated in various rotations, by different methods of seed-bed preparation and systems of continuous cropping.

The experiment plots were  $\frac{1}{10}$  of an acre in area, separated from each other by paths 4 feet wide. Two to six year rotations were tested. The cultural methods were the same at both stations: — autumn ploughing (to a depth of 7 inches at Judith Basin and 8 inches at Huntley, one plot at each station being ploughed only 4 inches deep) left rough throughout the winter except when autumn seed was sown; spring ploughing for spring seed (spring ploughing for maize being done immediately before sowing); listing for spring grain at the same time as autumn ploughing (for winter wheat the land was levelled just before seeding; listing for maize was done in spring); subsoiling, the subsoil plough following the plough; disking, usually just before sowing; plots to be left fallow were ploughed in May or early June and cultivated sufficiently to prevent subsequent weed growth. When green manure was used the ground was ploughed in autumn and the crops ploughed under when they reached their maximum growth. After sod crops — brome and alfalfa — it was found necessary to plough twice at both stations, first to about 3 inches, and later to about 7 or 8 inches. After ploughing, all the plots were cultivated sufficiently to give a good seed-bed, plots with the same method of seed-bed preparation being given uniform cultivation.

The rotations tested may be divided into four groups: — 1) 2-year rotation comparing fallow with maize land as a preparation for spring wheat and oats; 2) 3-year rotation containing two of spring cereal crops, wheat, oats, or barley, and either maize or fallow in the third year; 3) 3 and 4-year rotation including one green manure crop (rye, peas, or sweet clover), followed by a small grain crop, then, in the 3-year rotation, maize; in the 4-year rotation a second small grain crop came between the maize and green manure; 4) 5 and 6-year rotations comparing various sod crops and their effect on the following crops.

The results of the experiments are given in detail with many tables; they may be summarised as follows: —

In the 2-year rotation containing grains and maize or spring grains and fallow, the highest profit was obtained with the system containing maize.

In the 3-year rotation, containing spring grain and either maize or fallow the third year, maize proved more profitable than fallow.

In the 3-year rotation of 2 cereal crops and 1 of maize it was found more profitable to disc the maize land than to plough it as a preparation for one of the small grain crops. In rotations containing green manure

rye was found more satisfactory than peas for this purpose. The 3-year rotation containing green manure was less profitable than the 4-year rotation containing green manure. Three and four year rotations including green manure gave less satisfactory results than similar rotations in which clean fallow replaced green manure.

Rotations containing sod crops for two or three years gave comparatively low profits. Brome proved slightly more profitable than alfalfa.

In the continuous cropping experiments with winter wheat, autumn ploughing proved most profitable at Judith Basin and summer fallowing the least profitable. At Huntley the best results for winter wheat were obtained with summer fallowing, the worst with subsoiling.

In the spring wheat and oat series listing gave the most satisfactory results and summer fallowing the least satisfactory ones at Judith Basin; listing was also the most satisfactory method at Huntley.

At Judith Basin maize was most profitable on spring ploughing and least profitable on summer fallow. At Huntley maize did best on spring listing and worst on summer fallow. For flax spring ploughing was the most profitable and summer fallow the least so at Judith Basin, autumn ploughing the most profitable and subsoiling the least profitable at Huntley.

**1085 - Experiments on the Electro-culture of Growing Crops, in Scotland (1). —** HENDRICK<sup>1</sup> (Prof., Aberdeen University), in *The Scottish Journal of Agriculture*, Vol. I, No. 2, pp. 160-171 + 1 Fig. + 4 Tables. Edinburgh, April, 1918.

The experiments described were begun over 9 years ago by Mr. Low, of Balmakewan, on his farm of Mains of Luther, Kincardineshire. He tested on a field scale the effect of a high tension overhead electric discharge distributed on the system of the Agricultural Electrical Discharge Co., Ltd., upon ordinary farm crops. After experiments had been carried out on a large scale for some years upon a number of fields under the ordinary rotation of the farm without any distinct result being obtained, Mr. Low, in order to avoid some of the difficulties and sources of uncertainty encountered in the experimental method previously followed, drew up, in consultation with the author, a plan for a series of plots upon a selected piece of ground of an area of about 6 acres, situated in one of the fields of the farm.

The LODGE NEWMAN apparatus, supplied by the Agricultural Electric Discharge Co., Ltd., was used for producing and distributing the current. By this apparatus an ordinary 200-volt current is transformed by an induction coil into a high tension current of from 60 000 to 100 000 volts. By means of valves patented by Sir OLIVER LODGE a charge is accumulated on the overhead network. These valves allow electricity to pass only in one direction, and so only current of the desired sign can flow to the overhead network, and it is retained there save for leakage and for discharge from the fine radiating wires through the air. The effect is to make the field with the growing crop and the network a leaky condenser, the field and crop being charged with negative electricity while the overhead network has

(1) See also *R.*, January, 1918, No. 10. (*Ed.*)

a positive charge. As the apparatus has already been described on many occasions it need not be mentioned further (1).

The apparatus was installed by the officials of the Agricultural Electric Discharge Co., Ltd., and was on various occasions visited and inspected by their representatives. Improvements were installed at considerable expense by Mr. Low to avoid leakages, etc. In fact, he had adopted all the suggestions made by the society's experts who expressed themselves as quite satisfied with the apparatus and the way it was worked.

The plots were laid out early in 1913 in a fairly level field of good loamy soil. The rotation was turnips, barley, hay, pasture, and oats; in the fourth year the pasture was replaced by potatoes as being of greater interest for the experiment. Ten plots, each 0.558 acre, were laid out. Each plot was divided into 6 sections, divided by a neutral portion into two parts, one of which was electrified while the other served as control.

Owing to the recommendations given by Prof. PRIESTLEY and Mr. JORGENSEN, a screen of wire netting was erected to cut off the charge from the control sections. Tests made showed that the presence of the screen did not entirely prevent the distribution of the discharge over the control plots, especially when the wind blew strongly.

As regards the manuring all the plots were treated equally; as regards the soil it was found that the area of the controls was inferior in quality to that of the electrified area, and this was taken into consideration in considering the results.

The general results obtained in 1917 show that the barley of the electrified plots gave a better yield (an average of 2267 lb. of grain and 29 cwt. 1 qr. of straw) than that of the control plots (an average of 1725 lb. of grain and 24 cwt. of straw); this can only be due to the electrification. Unfortunately this result is not confirmed by the other crops. The potato crop was very good in 1917, and in every case it was heavier on the control than on the electrified areas. The same took place for the hay and oats. The swedes were not included as they suffered from attacks by pests and were blanky. The whole of the turnip crop was uneven in 1917, but so far as the results go the electrified areas have a distinct advantage. It cannot be concluded from the 1917 results that electrification is for some reason specially favourable to barley, for similar results were not obtained in other years.

CONCLUSIONS. — In the experiments at Mains of Luther, the application of a high tension electric discharge on the LODGE NEWMAN system to growing crops have been thoroughly tested over a period of 5 years and no consistent improvement in any of the crops grown — oats, barley, hay, potatoes, turnips and swedes — was obtained. There seems no reason to suppose that electric current applied in this way to growing crops will give results that repay the cost and trouble incurred. Much more scientific work requires to be done to determine the effect of electric discharges on

(1) See "Electricity and Crop Production" by T. H. PRIESTLEY, *Jour. Board of Agr.* 1913. XX, pp. 584-587. (*Author*)

growing plants before we can apply such treatment economically to farm and garden crops or even to decide what kind of apparatus should be used.

Great care is needed in reporting the results of electrocultural experiments so as not to create premature hopes of immediate practical results which, when they are not confirmed, cause disappointment and lead practical men to conclude that science merely leads to useless and wasteful expenditure.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

1086 — **New Plants and Seeds Introduced into the United States during the Period from January 1 to March 31, 1916** (1). — U. S. Department of Agriculture, Bureau of Plant Industry, Inventory, No. 42 (Nos. 39 682 to 40 388) of Seeds and Plants Imported by the Office of Foreign Seed and Plant Introduction During the Period from January 1 to March 31, 1915, 123 pp. + 9 Plates. Washington, 1918.

Mr. F. N. MEYER undertook a botanical expedition into the province of Kansu, China, and brought back a large number of interesting plants, including the following : —

Some large-fruited wild free-stone peaches (*Amygdalus* spp.) ; the Tangutian bush almond (*Amygdalus tangutica*), very resistant to drought and cold ; a wild pear (*Pyrus ussuriensis*), of the melting juicy type, quite distinct from the hard, gritty ones characteristic of China ; a small vine (*Vitis* sp.) with small bunches of black, edible grapes ; wild, hardy peaches (*Prunus armeniaca*), which may be used for hybridisation work with the aim of extending successful apricot culture further north ; a hardy dwarf crab apple (*Malus* sp.) found at an altitude of 9 000 ft. ; a wild gooseberry (*Ribes alpestre giganteum*), growing to a height of 15 ft., found on dry embankments, a promising hedge plant for the cold, semi-arid districts of the United States ; a very vigorous currant (*Ribes* sp.) found at an altitude of 7 000 ft. growing to a height of 25 ft., a wild cherry (*Prunus setulosa*), a promising stock plant ; Potanin's peach (*Amygdalus persica Potanini*), a bushy plant resembling *A. Davidiana* (so successful as a stock plant) which may prove yet more drought-resistant than this latter ; two wild plums (*Prunus* spp.) from Shensi Province, with possibilities for hybridisation work ; a species of *Citrus* with fruit resembling that of a sour mandarin, which appears to be unusually hardy ; *Populus suaveolens Przewalskii* ; *Daphne tangutica*, an evergreen bush ; *Lonicera* sp., a bush honeysuckle for low hedges in cold districts ; *Schizandra sphenanthera*, an excellent plant for shady beds ; a late-flowering, climbing *Polygonum* ; a new form of Wilson's horse-chestnut (*Aesculus Wilsonii*) from near Chenghsien, Kansu.

The most noteworthy introductions made by correspondants are : — four varieties of maize (*Zea Mays*) from the Valley of Nmaihsa, Upper Burma, where at an altitude of 5 000 to 6 000 ft. there is a remarkable cultivation of maize which appears very ancient ; on one of the varieties were found signs of the characteristic waxy endosperm hitherto only found on maize from eastern China ; a remarkable collection of 27 Spanish maize varieties ; 24 varieties of sweet potato (*Ipomoea Batatas*) from the Station at Santiago de las Vegas, Cuba ; a spineless cactus (*Opuntia* sp.) with very few spicules

(1) See also R., June, 1918, No. 628. (Ed.)



which grow on the dry islands of the Hawaiian group where the Burbank spineless cactus dies rapidly; "mitsuba" or "mitsubajeri" (*Deringa canadensis*) one of the most popular vegetables of Japan; the young leaves are eaten boiled and the roots fried; the Porto Rican black walnut (*Juglans portoricensis*), the nuts of which ripen in April and May; the red bush nut (*Hicksbeachia pinnatifolia*) from New South Wales; late-flowering varieties of English walnut (*Juglans regia*) from Grenoble, France; the Tibetan tree hazel nut (*Corylus chinensis*) which grows to a height of 100 ft.; the small-fruited wild walnut (*Juglans regia*) from Kansu, which is probably very hardy; a new form of Chinese chestnut (*Castanea* sp.) with slender trunk, comparatively resistant to disease; *Pyrus mamorensis* from the Moroccan forests of Mamora, which is resistant to drought and thrives in sandy, non-calcareous soil; 13 varieties of plum (*Prunus bokhariensis*) from Sehaurunpur, India, where they bear fruit from May to the end of June and are adapted to the hotter districts of the United States; the dried fruit of a white mulberry (*Morus alba*) from Afghanistan, where it is largely grown at Kabul; during 8 months of the year these dried fruits form almost the only food of the poor classes there; as Kabul has very cold winters and intensely hot summers, it may be possible to grow this mulberry in Great Plains; the "limoncella" apple from southern Italy considered superior to any variety grown in southern California; a black sapote (*Diospyros ebenaster*) from the Isle of Pines; the durian (*Durio zibethinus*) from Java; a rare species of anona (*Anona scleroderma*) from Guatemala; the Harrar fig (*Ficus* sp.) from Abyssinia, which can stand heavy summer rains and may do well in Texas; the sycamore fig (*Ficus Sycomorus*); the finger citron (*Citrus medica sarcodactylis*) of Japan; numerous shade trees and shrubs for parks and gardens, among which are: — the Egyptian tamarisk (*Tamarix aphylla*) which grows well in reclaimed desert lands where the irrigation water is quite saline; 3 tamarisks from the Caucasus — *T. Hohenackeri*, *T. pentandra* and *T. sp.*; the giant-fruited oak (*Quercus insignis*) (1) from Zacupam, Mexico; *Pittosporum floribundum* and *P. macrophyllum*, from Nice, France; the Guadeloupe Island palm, *Erythea edulis*, possibly suited to the South Atlantic district of the United States; a collection of Japanese flowering cherries (*Prunus serrulata*) from the municipal nursery of Tokyo; the large, wild cherry tree of Japan (*Prunus serrulata sachalinensis*), very hardy and long-lived, sometimes attaining a height of 80 ft., *Tilia euchlora*, a lime the leaves of which are not attacked by insects; *Chaenomeles japonica*, a fine red-flowered quince; *C. lagenaria cathayensis*, the large-fruited Chinese quince, the fruit of which is used in scent making; *Rosa Webbiana* from the Himalayas and *R. sertata* from central China.

1087 — Plant Ecology and its Relation to Agriculture. — WATERMAN, W. G., in *Science*, New Series, Vol. XLVI, No. 1184, pp. 223-228, Lancaster, Pa., September 7, 1917.

The author defines ecology as the *science of organisms as affected by the factors of their environment*; it is connected with both morphology and phy-

(1) See R. 1914, No. 1131. (Ed.)

siology, but more closely with the latter. Up to the present the methods of ecology have been largely descriptive, but now they are becoming increasingly quantitative, employing, in many cases, elaborate and delicate instruments. The experiments are made in the field and in the laboratory under both controlled and natural experimental conditions. The chief aim of ecology and the object of its observations and determinations are to determine the various phenomena observed and to draw from the data obtained the general principles underlying the reaction of plants to their environmental factors.

Plant ecology may be divided into *general ecology* and *special ecology*.

General ecology includes:— 1) *autoecology*, which studies the plant as an individual and is chiefly physiological; 2) *synecology*, which studies the plants in mass and is largely concerned with distribution, and may be regarded as an application of autoecology to the grouping of plants and other organisms within greater or smaller areas of the earth's surface. It may in its turn be divided into *phytogeography*, in which the groupings are regional and result from climatic factors, and *physiographic ecology*, in which the groupings are local, as the result of physiography subordinated to climatic conditions. These different groupings are called *associations*, and the fact that different associations follow each other successively is expressed by the term *succession*.

*Special ecology* of structural groups may, for plants, be subdivided into:—

*Ecology of trees and shrubs*, including the autoecology and the synecology of the group, the influence of the various species on their environment and their classification according to their utilisation.

*Ecology of herbs*, including the study of herbs as distinguished from the preceding group and their classification according to their economic value to man.

*Ecology of the lower types of plants*, with which bacteriology, mycology, etc. are concerned.

Using the word agriculture in a wide sense as denoting the cultivation of the plant products of the soil, its relation to ecology may be studied from the following three points of view:—

**ECOLOGICAL AGRICULTURAL PROCESSES.** — These include:—

1) The formation of optimum conditions:— the preparation of the soil, choice of seed and reproduction material, choice of suitable time and position for the crop; 2) the maintenance of optimum conditions:— the preservation of the moisture and physical and chemical conditions of the soil; the influence of soil temperature; suitable measures for regulating the light, temperature, and wind; control of plant diseases; 3) the harvesting of the crops, where the only function of ecology consists in determining the period most favourable to a maximum yield.

**CONTRIBUTIONS OF ECOLOGY TO AGRICULTURE.** — These may be of two kinds — 1) the development of the principles on which practical agriculture is based; 2) the supply of information for the solution of specific questions and problems bearing on agriculture.

As illustrations of definite contributions of ecology to agriculture may

be quoted the results of research into plant transpiration, and the soil moisture content in relation to the wilting coefficient, and the application of these results to the determination of the amount of water required in irrigation. The study of the extension of the root systems is also important in determining the relation of plants to the moisture content of the soil. No less useful have been the investigations into light, chemical content and plant succession in marshy land. The application of ecological principles in the choice of xerophytic plants for fixing moving sand has also proved of great value.

The difficulties incurred in estimating the measurements of the various ecological factors may be overcome by adopting LIVINGSTON's suggestion of using the living plant as an index instead of carrying out a series of determinations for each separate factor.

Finally the author recommends the introduction into agricultural studies of a course of ecology as a complement to morphology and plant physiology and an introduction to practical agriculture. Whereas the methods followed in practical agriculture, as well as those in agricultural research, are still theoretical, those used in ecology are scientific, although the study material is much the same as that of agriculture, to which ecology would be most largely applied. It is, nevertheless, obvious that ecology belongs to botany as well as to agriculture, and, instead of being a cause of controversy between the two it should be a means of cooperation between both to maintain a high standard in research and generalisation into the conditions under which plants respond to environmental factors.

**1088 - Crop Centres of the United States from an Ecological Point of View.** — WALLER, A. E. (Contribution 99 from the Botanical Laboratory of the Ohio State University, Columbus, Ohio), in the *Journal of the American Society of Agronomy*, Vol. 10, No. 2, pp. 49-83 + 8 Figs. + Bibliography of 25 Publications. Lancaster, Pa., February, 1918.

The geographical distribution of the principal cultivated crops of the United States appears to coincide with the well-known centres of wild vegetation, that is to say, with the districts where the combined action of the climatic and "edaphic" (1) factors form a centre favourable to the development of the species which constitute the local type of vegetation. By comparing the climatic data (chief among which are precipitation and evaporation) and "edaphic" data (dealing with the physical and chemical properties of the soil considered as factors in the distribution of the species) with the distribution of the principal crops of the United States (from information given in a study published by the Department of Agriculture (2) the author confirms the concurrence of the various crop centres of the United States with the centres of wild vegetation.

The maize and winter wheat belts correspond to the central deciduous forest and the prairie centres, the artificial pasture belts to the north-eastern

(1) See R. Dec., 1912, No. 1606. (Ed.).

(2) SMITH M., BAKER, O. E., and HAYWORTH, R. G., *A Graphic Summary of American Agriculture. Yearbook of the U. S. Dept. of Agriculture*, 1915, pp. 329-403 + 4 Diagrams + 38 Maps. Washington, 1916.

evergreen forest, the cotton belt to the south-eastern evergreen forest, the natural pasture or savana belts to the undulating semi-arid districts, unless dry-farming or irrigation have to be reckoned with.

The ratio  $\frac{\text{precipitation}}{\text{temperature of the evaporating surface} \times \text{wind velocity} \times \text{relative humidity}}$ , that is to say, the ratio between precipitation and evaporation, is a useful criterion for marking the limits of the different centres because it is based on factors which greatly influence plant growth. Edaphic factors also frequently determine the distribution of cultivated plants, and, though they may be independent of climatic factors in their effects, often determine the use of the same agricultural methods. The distribution of spring cereals (wheat and oats) is chiefly influenced by edaphic factors. On the other hand economic factors modify the influence of climate and soil, as is especially the case with the potato, the cultivation of which depends largely on soil conditions.

When cultivated crops are grown outside their usual centre their behaviour differs largely from that of the wild plants. The crops are found in the best soils, as only in this case can they compete with the other plants. Many invading plants can, however, only compete with the wild growth in the worst soils; in the better ones the plants of the district have little to fear from invaders. Exotic crops not only demand the best soils but also certain modifications of the soil and, in extreme cases, climatic modifications, i.e., they must be grown under glass or shelter.

Domestic animals are also distributed according to the production centres of the crops upon which they are most dependent. Thus, the dairy industry is concentrated in the artificial pasture belt, the breeding of beef cattle and swine is centred in the maize belt, horse breeding in the oat belt mules are largely found in the cotton belt and sheep in the arid districts,

To sum up, the methods of studying the succession of wild plants can be applied to cultivated crops so long as the conditions produced by the past and present physical factors are definitely determined. The migration of plants, which may lead to their invading another district and competing with and dominating the native plants, is the direct result of the combined action of climate and soil on vegetation. In this connection too much stress cannot be laid on the value of the methods of thorough research used by ecologists in determining the habitat of plants, methods which include the use of instruments for the exact determination of the moisture, temperature, and evaporation, as well as the recording of plant growth in relation to its surroundings by means of photographs.

1089 - A Note on the Analysis and Composition of the Seed of the Silver Maple (*Acer Saccharinum*). — ANDERSON, J. (Chemical Laboratory, New York Agricultural Experiment Station, Geneva), in the *Journal of Biological Chemistry*, Vol. XXXIV, No. 3, pp. 509-513. Baltimore, June, 1918.

In the belief that the seeds, or samara, of the silver maple had never been previously analysed or used as a food, the author made an analysis of them without, however, carrying out digestibility tests.

The samaras dried to constant weight in a current of air at a tempera-

ture of 40 to 50°C. lost 55.34 % of their weight ; 70 % of the dried samara composed the seed properly speaking, the other 30 % composed the wings (pericarp.) The powdered dried seeds, separated from the wings and outer seed coat by rubbing and sifting, gave on analysis the following percentages on a water-free basis :—

**COTYLEDONS.** — Starch 41.94 ; protein ( $N \times 6.25$ ) 27.50 ; sucrose 15.78 ; pentosans 4.07 ; galactan 1.08 ; crude fibre 2.36 ; crude fat, 3.55 ; ash 5.01, containing phosphorus 0.72 ; sulphur 0.16 ; chlorine 0.07 ; calcium 0.09 ; manganese 0.01 ; magnesium 0.18 ; potassium 0.70 ; sodium 0.07.

**PERICARP.** — Dextrose (reducing sugar) 6.11 ; sucrose 0.99 ; galactan 3.45 ; pentosans 15.24 ; starch 14.73 ; crude fibre 34.50 ; crude fat 2.40 ; protein ( $N \times 6.25$ ) 8.15 ; moisture 6.29 ; ash 3.98, containing manganese 0.018 ; sulphur 0.10 ; phosphorus 0.19 ; potassium 0.46 ; sodium 0.08 ; calcium 0.40 ; magnesium 0.10. •

Of the total phosphorus of the ash of the cotyledons (0.72 %) 0.65 % is soluble in 2 % hydrochloric acid (time of extraction = 3 hours) ; 50 % is organic and 15 % inorganic.

The total nitrogen content of the cotyledons is 4.40 %, 0.39 % of which is soluble in 70 % alcohol and 2.06 % in 5 % sodium chloride ; 1.93 % of the total nitrogen remains in residue.

The principal constituents of silver maple seeds are, therefore, starch, protein and sucrose. The principal protein is a globulin. It was found possible to isolate an organic compound of phosphorus very similar to, if not identical with, phytin. As has been seen, the ash is very rich in potassium and phosphorus, the latter being largely derived from the organic compound described above.

#### 1090 — The Chemical Composition of the Loganberry (*Rubus Idaeus Loganii*).

— See No. 1124 of this Review.

#### 1091 — The Chemical Composition of the Pineapple. — See No. 1125 of this Review.

#### 1092 — Stachydrin, a New Nitrogenous Compound Isolated from Alfalfa Hay in the United States.

— STEENBOCK, H. (Laboratory of Agricultural Chemistry, University of Wisconsin), in the *Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 1-13. Baltimore, July, 1918.

When analysing alfalfa hay it had been noticed that variations in the histidine and lysine contents determined by different methods in the water soluble nitrogen were attributable to an unidentified nitrogen compound. Considering the importance of each amino-acid in estimating the food value of a ration the author attempted to obtain more complete data on this compound. He successfully isolated from the phospho-tungstic acid fraction of the water-soluble constituents of alfalfa hay a pyrrol derivative, identified in the form of picrate, chlorplatinate, aurate, etc. with the same properties as the compound isolated by VON PLANTA from *Stachys tuberosa* and called by him "stachydrin". It represents one of the many nitrogenous compounds supposed to exist in the water-soluble fraction of foods. Alfalfa hay only contains a small quantity of it, corresponding to 0.5 % of the total nitrogen.

- 1093 — **Discovery of a Cyanogenetic Principle in Toad-flax (*Linaria minor* Desf.).** — GARD, M., in *Comptes rendus de la Société de Biologie*, Vol. LXXXI, No. 12, pp. 621-622; Paris, June, 1918.

In the Scrofulariaceae family, in which hitherto only one species containing hydrocyanic acid was known — *Linaria striata* D. G. (studied by BOURQUELOT, *Journal de Pharmacie et de Chimie*, Ser. VI, Vol. XXX, 1909, Paris) — the author has just discovered that another species *L. minor* Desf. contains a cyanogenetic principle. This plant is very common in Europe, from the Mediterranean district to the north of the continent, except in the arctic zone, and grows in sandy soil. After the cyanogenetic compound had been recognised by the ordinary method — crushing, digestion, distillation and reaction to Prussian blue — it was estimated by LIEBIG-DENIGÉ'S method. It was found that 100 gm. of fresh material contained 0.05832 gm. of hydrocyanic acid, a much higher content than that (0.01478 gm.) found by BOURQUELOT for the other species of this family, *L. striata*.

- 1094 — **Composition of a Plant Salt from the Cameroons.** — LACROIX, A., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVI, No. 25, pp. 1013-1015 + 3 Tables. Paris, 1918.

It has often been reported that, in African districts where there are no salt deposits and the importation of salt is difficult, the natives use for eating a salt extracted by lixiviation of the ashes of various aquatic or marsh plants (Gramineae, Aroideae, Polygonaceae, ferns, etc., according to the tribe). The first analyses of this salt (DEMOUSSY and DUBOWSKI) showed it to consist mainly of potassium chloride accompanied by variable quantities of sulphates and, sometimes, potassium carbonate. The author analysed a sample of such salt; it was a yellowish-gray in colour and coarse, obtained from a grass which appeared to be a form of *Panicum Crus-Galli*. He found it to contain a certain amount of lime and to be lacking in carbonate, thus differing from all the salts of other localities. A crystallographical examination confirmed the results of the analysis and showed the salts to contain the double salt known as syngenite,  $(\text{SO}_4)_2 \text{Ca K}_2 \text{H}_2\text{O}$ , sylvine, KCl, glaserite,  $\text{K}_2\text{SO}_4$ . In this product of the lixiviation of plant ashes is found, then, the association of the two minerals, sylvine and syngenite which is found in natural salt deposits.

- 1095 — **Relation Between Pigmentation and Oxidation Phenomena in Plants; a Study of the Comparative Respiration of Red Leaves and Green Leaves.** — NICOLAS, G., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVII, No. 3, pp. 130-133 + 2 Tables. Paris, 1918.

Numerous investigations have established the relation between pigmentation and oxidation phenomena in plants, but this relation has not been sufficiently supported by experiments on respiration. For this reason the author studied the comparative respiration of: — 1) green leaves and leaves which have turned red accidentally (excessive light, lowering of temperature, fungoid action); 2) leaves which are red when young and turn green as they grow old (*Rosa*, *Cassinia*); 3) green leaves and normally red leaves of the same species (*Prunus cerasifera* and *P. cerasifera* var. *Pissardi*).

The experiments were made by the confined atmosphere method and led to the following conclusions:—

A) **RESPIRATORY INTENSITY.** — In *accidentally* reddened leaves or those red when young and green later, the respiratory intensity is *higher* than in green leaves of the same species, especially with respect to the oxygen absorbed. In *normally* red leaves the respiratory intensity is *lower* than in green leaves of the same species. Red leaves form larger quantities of organic acids than the green leaves; this is expressed by greater oxygen fixation and a decrease in the ratio  $\text{CO}_2 : \text{O}_2$ . There is, therefore, a relation between the formation of organic acids, accompanied by the appearance of the red pigment, and the development of anthocyanin.

B). **RESPIRATORY QUOTIENT.** — In red leaves the respiratory quotient is generally *lower* than in green leaves. Leaves in which anthocyanin has developed consequently fix more oxygen than green leaves. This relation between the formation of anthocyanin and respiratory oxidation is indirect, the oxygen fixed is not connected with the anthocyanin generators, which result from a reduction action (recent research has proved pigmentation to be a reduction, not an oxidation phenomenon). The oxygen acts on other substances, probably the carbohydrates, to form organic acids which are far more abundant in red leaves than in green leaves.

1906 — **Immunity of Plants to the Principles Formed by them.** — COMBES, R., in *Comptes rendus de l'Académie des Sciences*, Vol. CLXVII, No. 7, pp. 275-278 + 2 Figs. Paris, 1918.

Since 1909 the author has conducted bio-chemical investigations into the physiological importance of glucosides in plants (see *Revue Générale de Botanique*, Vol. XXIX, No. 347, p. 321. Paris, 1917). In the course of his work he observed the following facts with regard to the immunity of plants to the principles they form.

Having cultivated several species — corn-cockle (*Agrostemma Githago*) which forms agrostemma-saponin, peas (*Pisum sativum*), buckwheat (*Polygonum Fagopyrum*) and radish (*Raphanus sativus*), which do not form this saponin — in Knop's fluid or in this fluid with the addition of 0.10 to 10 thousandths of the glucoside in question (agrostemma-saponin) he was able to show decisively from the outset that this saponin (even in 0.10/100) is injurious to the roots of plants which do not produce it — peas, buckwheat and radish — but has no injurious effect (even in 10/100) on the plant which forms it — corn-cockle.

The injurious action of the glucoside on the three species which do not form it is seen in the roots, the small, absorbent hairs of which disappear, in the arrest of growth, a loss of dry matter, and, in the pea, by folds on the surface of the root, as is shown by figures given in the paper. On the other hand, corn-cockle cultivated in the presence of the glucoside has shorter, but thicker, roots; the absorbent hairs are also shorter, but in good condition; in fact, there is no sign of disease. It may be concluded that the superficial cells of the corn-cockle root are distinctly immune to the saponin formed and accumulated in its seeds.

Apart from the interest of this fact from the point of view of the immunity of the plant with respect to the products it forms, the author draws

attention to a result of interest as regards physiological technique. When, to study the action of the immediate principles in the vegetable organism, the plant is cultivated in the presence of these principles, it is necessary to use only the species which produces them, otherwise there is danger of drawing false conclusions as to the action of these principles under the natural conditions of the species which forms it.

1097—**Antagonism Between Growth and Reproduction in Plants; Factors Influencing these Two Processes.**—BLACKMAN, V. H. (Imperial College of Science and Technology, London), in *Science Progress*, Vol. XIII, No. 49, pp. 49-53. London, July, 1918.

It is well known that in many plants there is a marked antagonism between growth and reproduction. In such cases (especially in fruit trees), the reduction of vegetative growth, e.g. by root pruning, causes vigorous reproduction. The study of the factors influencing these two processes is, therefore, of great importance. In higher plants, however, it presents great difficulties because of the close connection between the various external factors, none of which can be artificially modified without modifying others at the same time. It is, therefore, necessary to use lower species, algae and fungi, the cultivation *in vitro* of which presents little difficulty and may be made under conditions easy to modify. The facility with which such cultures may be made has led to neglect largely the study of the intervening features, such as temperature, aeration, etc., and the attention of workers has been concentrated especially on the composition of the media (PASIEUR, RAULIN, WINOGRADSKY, BEIJERINCK). One of the first workers to study the influence of external factors on pure cultures of algae and fungi, KLEBS, showed that growth and reproduction are dependent on certain of these factors, and that, in the presence of factors favourable to growth, reproduction does not occur. He also showed that the factors favourable to reproduction are more restricted than those favouring growth. KLEBS' theory has been confirmed by investigations into the biology of a fungus, *Plenodomus fuscomaculans*, made by COONS (*Journal of Agricultural Research*, Vol. V, No. 16 pp. 713-769, 1916) (1). These investigations showed, amongst other things, that light is an essential factor for reproduction, but that it may be replaced by a few drops of hydrogen peroxide or other oxidising agents. This fact suggested the hypothesis that there exists between the parts of an organism a strong competition for oxygen, and that in the presence of factors favourable to growth all the oxygen is used for metabolic processes. Under the influence of light or an oxidising agent, oxidation of the richer cell materials takes place, liberating a certain amount of energy, which changes the reserve food stuffs into complex protein bodies, the spores.

PLANT  
BREEDING

1098—**The Heredity of Early and Late Ripening in an Oat Cross, in England.**—ST. CLAIR CAPOIN, A., in the *Journal of Genetics*, Vol. 7, No. 4, pp. 247-257 + 1 Fig. Cambridge, August, 1918.

The results are given of experiments in the inheritance of earliness by crossing the early oat, Mesdag (ripe on July 26 in 1913) and the late oat Hopetown (ripe on August 13 in 1913).

(1) For abstract of this paper: see R. May, 1916, No. 572. (*Ed.*)



In spite of the relatively long ripening stage (from the appearance of the first panicles till all the panicles are completely ripe) there is no overlapping of the phases of the two varieties, in fact there is always a distinct gap between them as Mesdag is always completely ripe before any of the Hopetown panicles are ready for harvesting. The observations made from three generations of hybrids are given below.

*F* Generation. — Hybrids with long, strong awns, brown grains (like the parent Mesdag), compact panicles (like the parent Hopetown), ripening a little before the late parent and a little after the early one. They, therefore, had characters intermediate to those of the parents with a tendency on the part of Mesdag to dominate.

*F*<sub>2</sub> Generation. — As all the plants were harvested at the same time the results were not very definite or certain. Nevertheless, a careful examination showed the presence of:— 1) early forms (like Mesdag); 2) late forms (like Hopetown); 3) intermediate forms.

*F*<sub>3</sub> Generation. — Grains from 106 panicles chosen from *F*<sub>2</sub> were sown in separate rows; there was also a row for grains from each of the parents. From the beginning of the ripening period the number of ripe plants in each row was noted daily. Plants were called ripe when the last trace of green had disappeared from the tips of the paleae. The data thus obtained made it possible to calculate with exactitude the earliness of each row. An examination of the table in which these data are set out shows the following facts:—

1) Mesdag : ripening period from August 10 to 24.

2) Hopetown : ripening period from September 4 to 21.

There was, therefore, an interval of ten days between the ripening periods of these two parents.

3) In the *F*<sub>3</sub> hybrids there were forms intermediate to the two parents.

4) In no row were there plants as late as Hopetown.

5) In no row were there plants as early as Mesdag.

Nevertheless, in two rows (Nos. 17 and 97) the delay was very slight (2 to 3 days), so that their earliness might be considered practically equal to that of Mesdag. The two rows out of a total of 106, gave the ratio 1 : 63.

6) In 24 rows the ripening period extended over the ten-day interval between the ripening periods of the two parents, *i. e.*, was not ended on September 4 when the first ripe panicles appeared on Hopetown. The number 24 is very close to the theoretical number 26.5 ( $106/4$ ) corresponding to the ratio 1 : 3.

CONCLUSIONS. — The results obtained seem to show that early and late ripening are Mendelian characters depending on more than one factor; perhaps three *F*<sub>2</sub> plants homozygous for one of these factors are early in the sense that their *F*<sub>3</sub> descendants are completely ripe before any plant of the late parent. On the other hand, only homozygosis of the three factors can produce earliness equal to that of the early parent. The various combinations of these factors, their absence or their presence in the homozygous or heterozygous state, explain all the intermediate conditions.

**1099 — Selection of Maize Resistant to Smut (*Ustilago Zeae* Beck), in the United States.** — JONES, D. F., in the *American Journal of Botany*, Vol. V, No. 6, pp. 295-300 + Bibliography of 19 Publications. Lancaster, Pa., June, 1918.

For these selection and hybridisation experiments, made to study the inheritance of resistance to smut in maize, were used 16 strains of this cereal which had been self-fertilised for from 9 to 11 generations. At the beginning the progeny showed little uniformity, but this gradually increased till finally the homozygous state appeared to be attained and the various groups or types remained constant.

The strains thus obtained showed degrees of resistance to attack from smut varying between a minimum of 9.79 % of the plants from strain 1-7-1-1 and a maximum of 0 % for the strain 1-6-1-3, which may be considered as practically immune to the parasite. The vigorous development of the plants of this strain must not be considered as the chief cause of resistance because other highly immune strains develop only moderately.

By crossing a susceptible with a resistant type almost completely immune plants were obtained in  $F_1$ , whereas in  $F_2$  there were susceptible plants in a ratio agreeing with the laws of scission and re-combination of characters, although want of material has not yet made it possible to obtain definite data.

The results seem to show conclusively that susceptibility to smut is governed by special determinants or genetic factors and may be modified by suitable selection.

**1100 — Observations on some Degenerate Strains of Potatoes.** — STEWART, F. C., in the *New York Agricultural Experiment Station, Bulletin* No. 422, pp. 319-357 + 12 Plates. Geneva, N. Y., July, 1916.

The results are given of investigations made by the author in the experiment fields of the New York Agricultural Station at Geneva to determine the manner in which the potato diseases known as leaf-curl, curly dwarf, mosaic and spindling-sprout are transmitted from one generation to another. These seem to be less diseases properly speaking than forms of degeneracy, for in no case was it found possible to isolate pathogenic micro-organisms. The action of the soil and weather factors must also be excluded.

The two principle results obtained showed that :

1) The tubers of affected plants nearly always produce more or less degenerate and useless plants. In 1914 were chosen 47 badly affected specimens, from which were obtained, in 1915, 197 plants, all diseased with the exception of one (of the Ionia variety).

2) Perfectly normal plants (Pride of Vermont, Green Mountain, etc.) may produce degenerate types. Tubers of the same plant, and even different eyes from one and the same tuber, may produce both normal and abnormal plants.

This last fact, as well as the constant transmission of the degenerate types, seems to show that these hereditary diseases may be produced as real mutations or bud variations. This is born out by the rapid degeneration frequently observed in the descendants of perfectly healthy plants. For example, a tuber of the Green Mountain variety planted in 1913 gave

63 seed-pieces for the following year; all the plants produced from these pieces were healthy and perfectly normal. The tubers of 36 of these plants were planted in the spring of 1915 in three plots in three different localities, Riverhead (Long Island), Cadyville (New York), and Presque Isle (Maine), and produced in all three places many decidedly degenerate plants.

CONCLUSIONS. — 1) Tubers from plants affected with leaf-roll, curly-leaf and mosaic transmit these degenerate characters to their descendants. All tubers from plants which are even only slightly abnormal should, therefore, be eliminated.

2) Degenerate forms crop up unexpectedly as mutations from material which has been perfectly healthy for several generations, so that even a very careful sorting of seed tubers will not exclude the possible occurrence of abnormal descendants subject to degeneration.

1101 — **Deli-Tobacco with Petiolate Leaves. Probably Resulting from Mutation of a Single Factor, at Sumatra.** — HONING, J. A., in I. *Bulletin van het Deli Proefstation*, No. 10, pp. 1-24 + 5 Tables + 6 Figures, Medan (Sumatra), October, 1917; II. *Mededeelingen van het Deli Proefstation*, Year X, Pt. 8, pp. 185-189 + 6 Figs. Medan, December, 1917.

Now and again (once in 100 million times, or still less) Deli tobacco, which normally has sessile leaves, produces plants with leaves having a long petiole and also differing from the normal type by: — cross lines (1), a zigzag stalk, small, losenge-shaped leaves with small appendices on the under side ("Kroeppek") (2), sometimes growths on the corolla.

In 1914, in the plantation of Foentoengan (Sumatra), was found a Deli tobacco plant with petiolate leaves. It was self-fertilised and in the  $F_1$  gave 2896 plants which were divided into three different types: — a) 704 (about  $\frac{1}{4}$ ) of the normal Deli types; b) 1446 (about half) hybrid plants with leaves with petioles which were at first short but later grew till they were of the same length as those of the parent plant; c) 746 (about  $\frac{1}{4}$ ) sterile dwarf plants with irregular leaves, which first had a long petiole but subsequently lost the blade, so as to assume a linear form. The segregation, therefore, was in the Mendelian ratio of  $\frac{1}{4}$ :  $\frac{1}{2}$ :  $\frac{1}{4}$ , or 1: 2: 1, showing the parent plant to be a heterozygous hybrid with respect to a single factor (Aa).

Nine of these  $F_1$  hybrid plants on self-sterilisation gave an  $F_2$  including 4655 plants of which 1155 were normal, 2392 hybrids, and 1108 abnormal (dwarf), i. e., always in the ratio 1: 2: 1.

On the other hand reciprocal crosses between hybrid and normal plants of  $F_1$  gave normal and hybrid plants in the ratio 1: 1.

Finally, the normal plants (Deli type) of the  $F_1$  when self-fertilised instead of giving exclusively normal descendants gave, in two cases, a number of abnormal plants — 3 hybrids and 2 dwarfs out of a total of 764. This phenomenon is as mysterious as the origin of the plant with petiolate leaves of Foentoengan.

(1) The author calls thus the pale green lines placed, in the variety of tobacco with non-decurrent leaves, in the positions corresponding to the insertion of decurrent leaves in the varieties with normal leaves.

(2) See R. 1914, No. 288. (Ed.)

It is most improbable that this plant was derived from an accidental cross between Deli tobacco and the native tobacco with petiolate leaves because the characters of the Deli type reappear without variation in the  $F_1$  and other abnormal types, both homozygous and hybrid, resembling none of the tobaccos cultivated by the natives of Malaya and Batak.

The author explains the origin of this curious plant as follows — a germ cell of the Deli type was fertilised by a cell having but one changed factor, *i. e.*, having undergone *mutation* for one factor only (whereas DE VRIES considers the oöules of *Oenothera Lamarckiana* to have undergone mutation for several factors). In support of this hypothesis he calls to mind that a *single* factor may produce *several* effects, as has been shown by LODEWIJKS for tobacco (*Erblichkeitsversuche mit Tabak*, in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. V, p. 144, 1911) and MORGAN for other plants (*The Mechanism of Mendelian Heredity*, p. 35, 1915).

#### AGRICULTURAL SEEDS

**1102 — Variations in Seed Tests Resulting from Errors in Sampling.** — STEVENS, O. A., in the *Journal of the American Society of Agronomy*, Vol. X, No. 1, pp. 1-19 + 12 Tables + 3 Figs. Lancaster, Pa., January, 1918.

Variations in the results of seed testing are largely unavoidable. They may be divided into two groups, one purely mathematical, the other personal or, to a large extent, economic (due to lack of money to buy the best apparatus and to employ efficient and trained workers). The direct mathematical causes are:—

*For germination tests:*— imperfect mixing, random sampling, errors in counting, effect of personal selection (there is a tendency to pick out the better seeds), unsuitable conditions for germination, special condition of the seed.

*For purity tests:*— imperfect mixing, random sampling, errors in weighing, effect of personal selection, errors of identification.

During the years 1914 and 1915 the author investigated in the Department of Botany of the North Dakota Agricultural College the errors due to mathematical causes. Both in the germination and purity tests the general plan was for one person to take simultaneously a series of 50 tests from one lot of seed and to calculate the standard deviation and probable error.

**GERMINATION TESTS.** — A white-seeded kafir was chosen as experimental material. Part of the seed was stained red with an alcoholic solution of Delafield's haematoxylin to represent dead seed.

I. — To determine the amount of mixing required in a sample received by an analyst, 55 grams of white seed and 55 grams of stained seed were placed together and poured from one dish to another at the rate of 50 times per minute. This process was repeated 25, 75 and 200 times, and the whole series then duplicated. The probable error was respectively 3.10, 2.88, and 2.83 for the first series, and 3.05, 2.83, and 2.82 for the second series. This remarkable agreement shows that very little difference results from mixing beyond a certain limit. (In all the tests described the seed was mixed 75 times. To choose the sample to be tested the mixture was poured

on to the table, the pile drawn out to a point at one end by placing a hand on either side, and 100 seeds counted.

II. — The second problem was to determine the error for a given percentage. Theoretically a sample containing 100 % of live seed should give no variations in the various tests; a sample with 90 % live and 10 % dead seed should give the same variations as one with 10 % live and 90 % dead seed, and so on, till the maximum variation is obtained with 50 % of each type. When a test sample also contains hard seed the variation will be greatest when all three kinds of seed are present in equal proportions. The probable error for such a sample was found to be 3.83, 3.92, and 3.01 for the live, dead, and hard seeds respectively.

The author gives in a table the probable errors in the percentage of live, dead, and hard seeds determined by him from mixtures containing 50, 60, 70, 80, 90, 95, 97, and 99 % of viable seed, in which (with the exception of the three last) the rest of the percentage was composed of: a) 5 % of dead seed, the remainder being hard seed; b) 10 % of dead seed, the remainder being hard. In another comparative table are given the results of four lots of seed (alfalfa, millet, bromus and red clover) tested in about 20 different laboratories, the probable error being calculated in lots of 100 seeds.

III. — The above figures were obtained for samples of 100 seeds. The limits of error were also investigated for samples containing a number of seeds equal to multiples of 100 or less than 100. For this purpose tests were made with several series of 200 tests with millet, alfalfa, flax, and kafir seed, each lot of 50 being made separately. The results were calculated for each set of 50 tests, for each set of 50 obtained by taking the mean of the first and second, third and fourth, and by taking the mean of each set of three and of four tests. Series based on 100, 200, 300, and 400 seeds were thus obtained the results of which are given in a table. For example, a mixture of alfalfa with an 83.0 % germination (9 % hard seeds) gave the following probable errors:— for the four series of 100 seed tests, 2.49, 2.62, 2.48, 3.02; for the two 200 seed tests, 3.01, 2.27; for the 300 seed test, 1.82, and for the 400 seed test 1.43. A mixture was also prepared containing 80 % of viable seed and a series of 500 lots of 100 seed each was counted in distinct groups or in combinations as in the previous case, and tests made using 100, 200, 300, 400, 500, and 1 000 seeds, with the following results:— for 100 seeds the probable error was 2.65; for 200 seeds, 1.78; for 300, 1.50; for 400, 1.35; for 500, 1.25; for 1 000, 0.85 %. When less than 100 seeds were used the error was considerably increased. A trial with 50 % of live and 50 % of dead seed made with 50 lots of 50 and 25 seeds each, gave probable errors of 4.26 and 6.73 % respectively.

IV. — If the results of two tests of one sample vary rather widely is the mean of the two further from the mean of the series than when the variation between the two tests is less? In other words, is it necessary to make a new test when the variation between two tests exceeds a certain quantity?

To solve this problem the alfalfa series and kafir (60 % germination; 32 % hard) from the previous experiment and the 80 % kafir series were

used. The mean of each successive pair (1st. and 2nd.; 3rd. and 4th., etc.) was calculated, and the deviation of these means from the mean of the whole series of 200 found. In the alfalfa series 17 % of the duplicate tests showed a variation exceeding 10 %, their average deviation being 4.15 % (12 exceeded the probable error). The average deviation of the other 83 was 3.44 %. On the other hand, there was in one case 1 % difference only in the duplicate tests, the mean of the duplicates differing from the mean of the series by 9 %. Among the duplicate tests differing by 2 % only, two differed from the mean of the series by 6.5 %, and one by 5.5 %, etc. Of the 100 duplicates of the 60 % kafir series, 9 showed a difference exceeding 10 % of the mean of the two tests, and the mean of the entire series. The average deviation of the means of these 9 from the mean of the whole series was 2.44 %; that of the other 91, 2.97 %. In only 4 of the 9 did this deviation exceed the probable error of 2.2 %. In the 80 % kafir series 46 of the 250 duplicates showed a difference of over 8 %. The average deviation of the means of these 46 from the means of the whole series was 2.35 %, whereas in the other 204 cases it was 2.06 %. Only in 24 of the 46 cases did the deviation exceed 2 % (the probable error in tests of 200 seeds is 1.87 %). It is, therefore, clear that in such a case wide variations between duplicate lots does not appreciably reduce the accuracy of the results.

By the rule of the Official Seed Analysts of North America re-tests must be made when the variation between duplicates of 100 seeds exceeds 6, 7, 8, 9 and 10 % for a germination of 90 % or more, 80 to 90, 70 to 80, 60 to 70, and 50 to 60 % respectively. The author's results show this regulation to be of doubtful value, because the variation may be greater without destroying the value of the test, or it may be smaller and the exactitude of the result doubtful.

VARIATIONS IN PURITY TESTS. — These may be due to many factors since each of the three chief components of the sample (pure seed, foreign seed, inert matter) may have a variable number of components for which it is difficult to find a value of accuracy for use in a large series of cases.

The seed used did not show any unusual variations. In taking the samples a seed mixer and sampler such as adopted by the U. S. Department of Agriculture were used. Determinations were made of: — *a*) the probable error in purity tests of flax (2 lots), alfalfa, and brome grass; *b*) the value of the second decimal (as compared with only one decimal figure) in calculating the probable error; *c*) the variation in the number of foreign seeds in a given species; *d*) variations due to personal selection.

CONCLUSIONS AND RECOMMENDATIONS. — I. The probable error of a single germination test of 100 to 400 seeds for percentages of germination of 99, 97, 95, 90, 80 to 50 respectively varies as follows: — 0.75, 1.00, 1.50, 2.25, 2.80 in samples of 100 seeds; 0.50, 0.70, 1.00, 1.50, 2.00 for 200 seeds; 0.40, 0.55, 0.80, 1.20, 1.75, for 300 seeds; 0.35, 0.50, 0.70, 1.05, 1.50 for 400 seeds. The figures increase by about  $\frac{1}{5}$  in the lower percentages of germination for Leguminosae containing so-called "hard" seeds. This is for work in which the causes of variation are reduced to a minimum. No

attempt was made in this study to determine the range of value when factors other than those of mathematical probability enter to any extent. These values may be used for other experiments involving similar conditions, e. g. in counting 500 seeds to determine the percentage of mixture of two kinds.

II. — In samples which do not contain mixtures of materials with a tendency to separate readily (such as sand, fine impurities, or coarse material) only a small amount of mixing seems necessary. Such samples should receive a supplementary test of larger quantity to show the approximate amount of such materials. For example, these may be first separated by a sieve, and the percentage added to that obtained by a regular test from the remaining quantity.

III. — The accuracy of purity tests depends on many factors. The quantities used should be carefully investigated to determine whether those in current use may be advantageously changed. The second decimal figure is of no value in most cases. If such accuracy is required the determination must be made with a sufficiently large sample (e. g. for about 8 oz. of wheat 30 gm. should be taken; for flax and small seeds, three times the usual quantity).

IV. — Results of seed tests should be accompanied by an indication of their accuracy, *i. e.*, by the value of the probable error. In practical tests this should be doubled because there are about four chances in five that the correct result lies within the figure thus corrected.

V. — The second decimal figure is not necessary for the calculation of the probable error in such tests.

VI. — The amount of seed used for such tests (and therefore the degree of accuracy obtained) should be regulated by two factors — the degree of accuracy required for dependable results, and the amount of work it is possible to handle. In germination tests it is advisable to use 200 seeds per test, the number being increased if desired. It is most important to know the probable error so that such adjustments may be made.

VII. — Duplicate tests appear to be of little value; one test of 200 seeds will often require less space and time than two of 100 seeds.

The author compares his results with those of RODEWALD (*Über die Fehler der Keimprüfungen, Landwirtschaftliche Versuchsstationen*, Vol. XXXVI, pp. 105-112, 215-227; 1899), with which, on the whole, they agree well.

1103 — **Date and Rate-of-Seeding Tests with Spring Grains under Irrigation.** — ATKINSON, A., in the *University of Montana, Agricultural Experiment Station Bulletin* No. 120, pp. 107-117 + 15 Tables. Bozeman, October, 1917.

CEREAL  
AND PULSE  
CROPS

The experiments described were carried out at the Montana Experiment Station farm at Bozeman, in the Gallatin Valley in the south-central part of the State, at an altitude of 4870 ft. The plots were  $\frac{1}{40}$  acre in size. The tests were made with the principal varieties of cereals, sown in lines with a seed drill carefully calibrated to control the exact quantity of seed sown. The influence of different dates and rates of sowing on the yields of grain and straw, the weight of grain per bushel, the length of the period from planting to ripening, the height of the crop, and the percentage

of the crop lodged at harvest time, were carefully observed. The tests were made during 8 years for spring wheat, oats, and barley, and during 7 years for peas. The principal results obtained are given below : —

**DATE OF SOWING.** — The largest yield of grain was obtained with the earliest sowing. Yield from plants sown on April 15, 22, 29 and May 5, when compared with those from plants sown on May 13, 20, 27 and June 4, showed an average increase, in favour of early sowing, of 44.6 % for spring wheat, 19.1 % for oats, 11.7 % for barley, and 10.6 % for peas. There were but slight differences in the quantity of straw produced according to the date of sowing. Since late planting gave smaller yields of grain, the number of pounds of straw for each pound of grain produced was greater for crops sown late than for those sown early.

Early sown grain was of better quality than late sown grain, as shown by a higher average weight per bushel. The vegetative period of early sown grain was longer than that of late sown grain. This was doubtless due to the fact that the growth of plants sown late was arrested by autumn frosts and cool weather.

There was no marked difference in the length of straw of the plants sown at different dates. This is in agreement with the essentially uniform yields of straw. Lodging of cereals depends more on the season than the date of sowing.

**RATE OF SEEDING.** — The highest yield of spring wheat was obtained by sowing 14 pecks per acre. This was 2.6 bushels higher than the yield obtained with 8 pecks. Considering the higher price of grain in the spring, the most profitable yield was from 8 peck seeding. The best yields of oats were obtained with 10 to 12 pecks of seed per acre. Sowing 16 pecks per acre gave the best yields of barley. When other conditions, such as lodging, were considered, the best yields were obtained with 8 to 10 pecks of seed. For peas, the most satisfactory results were obtained with 10 to 12 pecks per acre.

The yield of straw increased in proportion to the amount of seed used.

The quality of the grain as shown by the weight per bushel was slightly better for spring wheat, oats, and barley when larger quantities of seed were used. With peas the opposite was true. The larger the amount of seed used the shorter was the period from sowing to ripening. The amount of seed used should, therefore, be increased in proportion as the date of sowing is retarded in spring.

There appears to be no relation between the length of straw and the amount of seed sown in the case of spring wheat, oats, and barley. For peas, the length of the straw increased as the quantity of seed used increased. The higher the rate of seeding the greater was the tendency of the crop to lodge. It must be remembered that these data refer to irrigated crops at an altitude of 4870 ft.

**1104 — Comparative Cultural Experiments with Several Varieties of Oats in South and Central Sweden.** — AKERMANN, A., in *Sveriges Utsädeförenings Tidskrift*, Year XXVII, Pt. 6, pp. 261-278; Year XXVIII, Pt. 1, pp. 26-25. Malmö, 1918.

During the last 20 years the Svalöf station, aided by the various bran-



ches distributed throughout the different physiographical districts of Sweden, has created and tested several new and valuable varieties of oats which have replaced, or are replacing, the old native varieties which they exceed in quantity and quality of yield. As is known, the yield of a given variety varies from year to year according to the different weather conditions. To determine the climate of a given locality it is necessary to make a series of observations over several years, and to determine the productivity of a given variety with respect to the climate it is also necessary to make comparative cultural tests for a more or less long period.

Among the oats produced at Svalöf are the varieties Kron, Seger, Guldregn, Stormogul, Klock I, II, and III, selected Dala, and others. Comparative cultural experiments made on several farms in south and central Sweden have made possible good approximate determinations of the characters of these varieties with respect to the special climatic and agricultural conditions of the different provinces, thus enabling a geographical distribution to be made on a rational and reliable basis. The comparative cultural tests may be divided into four parts:—

- 1) Tests at Svalöf, from 1900 to 1917.
- 2) Tests in the provinces of southern Sweden (white oats district) from 1908 to 1917.
- 3) Tests in Värmland, from 1908 to 1916.
- 4) Tests of varying length in the provinces of central Sweden (black oats district).

I. SVALÖF (1900-1917). — Beginning with the Kron variety, which occupies the first place, the other varieties come in the following order of merit:— Gule Näsgård, Banner, Strubes Schlanstedter, Tystofte Stjern, Seger, Guldregn, Klock III, common Probsteier, beardless Probsteier, Stormogul, Ligowo, and Klock II. An examination of the weather conditions shows the well-marked positive action of rain during the vegetative period, from May 1 to August 15 in years when the total rainfall during this period is 200 mm. or more, especially if the rain is not only abundant, but also well distributed. When, however, this total is below 150 mm., as in 1914 (127 mm.) and 1917 (88 mm.), the yield in grain is  $\frac{1}{3}$  or more below the average. All the varieties are not equally sensitive to weather conditions, with the exception of those generally known to be favourable or unfavourable. Thus, in dry years, the Guldregn variety, which is very resistant, gives better results than Seger oats and, under the same conditions, the black oats Klock and Stormogul can compete with, and even excel, the best white oats. In 1917, for example, the first place was held by Stormogul with  $28\frac{3}{4}$  cwt. per acre, followed by the varieties Guldregn, Gul Näsgård, common Probsteier, Klock III, Seger, Kron, and Klock II. The choice of any variety must depend on the most unfavourable weather factor of the district in which it is to be grown.

II. SOUTH SWEDEN (1908-1917). — Of the white oats, the Seger variety holds first place in the provinces of Malmöhus (25.97 cwt. per acre), Kristianstad (23.29 cwt.), Södra Kolmar (22.17 cwt.), and Skaraborg (21.98 cwt.), but in this last province Stormogul black oats surpass all white oats.

The Kron variety does best in the provinces of Halland (23.62 cwt.) and Älfsborg (24.38 cwt.), whereas the Guldregn variety gives better results than Seger in one case only, in the province of Kronoberg (19.42 cwt.), where the unfavourable climatic conditions emphasise the properties of earliness and drought resistance peculiar to Guldregn.

III. VÄRMLAND. — Although included in the white oats district, this region must be considered separately. Two conditions deserve attention:— 1) the late spring which makes it necessary to sow 8 days later than in the Uppland; 2) the drought of June, especially in the southern parts and in the Dalsand (northern part). Thus, at Karlstad, the June rainfall does not exceed 46.5 mm., whereas at Nora it is 65.1 mm., at Falun 55.8 mm., at Örebro 55.4 mm., at Skara 51.1 mm. and at Vänersborg 57.9 mm. This shows the necessity of drought resistant and very early types. Among the white oats the Guldregn variety holds first place (15.71 cwt.) excelling both the Seger (15.07 cwt.) and Dala (14.77 cwt.) varieties, but it is decidedly inferior to the Stormogul (17.25 cwt.) and Klock II (16.26 cwt.) black oats.

IV. CENTRAL SWEDEN (1909-1916). — The black oats district includes the province of Östergötland and parts of those of Småland and Närke, as well as the provinces on both sides of Mälaren (Södermanland and Uppland).

*Östergötland.* — The Klock III variety, obtained by NILSSON by crossing Klock II with Stormogul, gave results (21.08 cwt.) so much superior to those obtained with the parent plants that it could safely be grown in the place of Klock II (18.71 cwt.).

Stormogul leads for yield in straw (42.11 cwt.), and by completely uprooting all *Berberis* it was possible to eliminate *Puccinia graminis*, so injurious to Stormogul which, in yield can compete with Klock III. The Fyris variety gave results superior to the parent variety Roslag.

*Mälaren provinces.* — Of all the varieties examined Stormogul gave the best results, both in heavy clay soils and in light sandy soils. Only in the northern parts of this district was it necessary, on account of its late ripening, to limit Stormogul to the fertile soil zone so as to favour rapid growth of the plant.

Klock III shows very good promise although there are not sufficient data available to establish with precision the district to which it is best suited.

On the whole the Fyris variety has given less satisfactory results than Klock, but in some very clayey parts of Mälaren and large tracts of Uppland this variety is to be preferred to all the other black oats on account of its earliness. From a point of view of quality of grain and tillering Fyris should prove of excellent use in selection and hybridisation experiments in the clay soils of central Sweden.

1105 — The "Kyko" Oat (*Avena sativa* var. *obtusata*) from Cyprus. — See No. 1075 of this Review.

1106 — The Control of Weeds in Ricefields by Rolling. — TARCHETTI, A., in *I Giornale di Riscoltura (Organo Mensile della R. Stazione Sperimentale di Riscoltura e delle Coltivazioni Irrigue, Vercelli)*, Year VIII, No. 4, pp. 51-58 + 2 Figs. Vercelli, April 30, 1918.

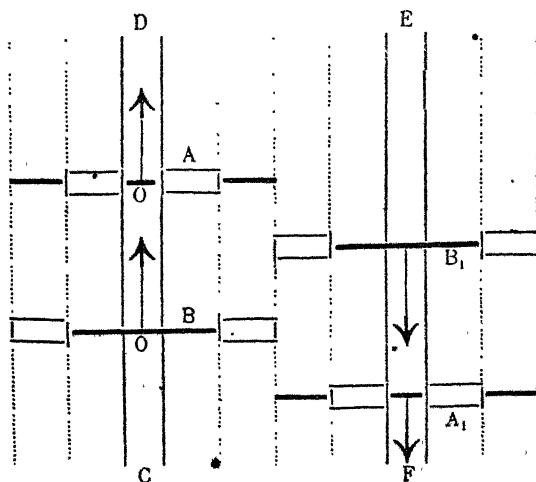
Although most farmers no longer use rolling as a means for keeping down weeds in ricefields — and the author thinks they were wrong in

abandoning the practice — many well-known practical men still use it on a large scale and repeat it each year with increasing success.

Rolling is specially successful in first-year ricefields and in these with numerous sedges; it should be abandoned for grasses. The corrugated roller (with wooden laths or iron bars  $1\frac{1}{2}$  in. sq.) should be used. The best time for rolling is when the sedges have grown as tall as the rice; during rolling sufficient water should be maintained in the ricefield so as to prevent the roller burying the rice plants in the soil so that they cannot grow up again. The trampling of the plants by the team and the difficulty of turning are two disadvantages that should be avoided or diminished. To this end, the suggestion has been made to make rollers with 2 or 3 sections with a total length of 10 to 13 ft. so that the land between two irrigation ditches could be rolled in 2 turns — going and coming; but this roller requires 2 horses instead of one and the trampling would be great.

The author suggests the use of a roller with 2 sections loose on an iron axle equal to the width of the land, so that the sections could be spaced as required on the axle. The swingle-tree for 1 horse is attached to the middle of the axle.

With a land twice the width of the roller, the 2 sections are moved towards the centre of the axle as shown at *A* in the figure, and the horse (2 horses may be used) walks in the ditch *CD*, thus rolling on both sides of the ditch. When at *D*, the apparatus is turned, the horse passing in the ditch *EF*, as shown at *A<sub>1</sub>*, and so on for the other trenches. When the first rolling is finished, the 2 sections are moved to the position *B*, and the operation is finished without ever trampling the young plant, save on the headlands. The headlands would be rolled last of all, so as to flatten out the hoof marks.



The use of a roller with 2 sections loose on the axle in a rice field.

1107 - "Huê-ky" Rice, an Indochinese Variety of Good Quality, Especially Suited for Western Cochin-China. — See No. 1068 of this *Review*.

## ILKE CROPS

1108 - The Production, Preparation and Uses of Raffia. — See No. 1075 of this *Review*.

1109 - Tests with Varieties of Cotton in Cyprus. — See No. 1075 of this *Review*.

1110 - Sunflower Pith, the Wood and Bark of the Baobab for Use in Paper-Making. — See No. 1075 of this *Review*.

CROPS  
YIELDING OILS,  
DYES AND  
TANNINS

1111 - Olive-Growing in Australia. — *Queensland Agricultural Journal*, Vol. 9, No. 1, pp. 18-20 + 1 Fig. Brisbane, January, 1918.

Before the war olive trees had never been grown on a commercial scale in Australia. As present supply difficulties on the European markets have stopped the importation of olive oil to Australia, the growing of olives is attracting much attention there.

South Australia may be said to be the only State producing olives. The total area of the olive orchards there only amounts to 1000 acres with an annual production of oil of about 15 000 gallons. The variety of conditions under which olive trees do well makes it certain that more extensive cultivation of them would succeed. Prof. PERKINS believes that the olive orchards could be extended to 15 000 or 20 000 acres, especially in districts with a light rainfall where the soil contains sufficient lime. The soil and climate of Queensland are just as well suited to olive growing as those of South Australia.

Mr. BURING, who has grown olives for many years, believes that the labour difficulties which olive growing on a commercial scale would encounter make it necessary to restrict the cultivation of this fruit to small orchards but that this should be general. In other words, he recommends all those who have orchards to reserve one plot for olives. He gives the Verdale variety preference over all others because, though its oil content is not very high in proportion to the weight of its fruit, it is the most resistant variety, thriving on the coast as well as inland, at sea level as well as at altitudes of 4 000 to 5 000 ft., and resisting very low temperatures.

It is usually assumed that olive trees do not come into bearing for several years. The use of fertiliser and good irrigation will, however, reduce this period and make it possible to obtain a crop four years after planting out.

1112 - Oil-yielding Seeds of British India. — See No. 1075 of this *Review*.

1113 - Oil-yielding Seeds of South and West Africa. — See No. 1075 of this *Review*.

1114 - The extraction of Berberine from "Michai" (*Barberis Darwinii*) and "Calafate" (*B. buxifolia*), in the Argentine. — RICHERT, F., in *Revista del Centro Estudiantes de Agronomía y Veterinaria de la Universidad de Buenos Aires*, Year XL, Nos. 92-93, pp. 11-13. Buenos Aires, January-May, 1978

"Michai" and "calafate" grow largely in the Patagonian Cordilleras. By extracting the powdered roots with hot water are obtained large quantities of berberine, a yellow colouring substance which fast dyes animal fibres without previous treatment with mordants. The natives use these aqueous extracts for dyeing mats, etc.

An experimental study made at the "Instituto quimico de Investigaciones agropecuarias" showed the dry powder of "michai" root to give 8.9% of crystallised berberine after extraction with hot alcohol, precipitation with ether and evaporation of the precipitate. The treatment of "calafate" roots is not so simple because the berberine in them is accompanied by other crystallisable compounds which are extracted simultaneously. In this case it is necessary to acidify the alcohol extract with dilute nitric acid. By these means 3.5 to 4% of crystallisable berberine nitrate is obtained.

1115 - The Cake from *Strephonema* sp. as Tanning Material. — See No. 1075 of this Review.

RUBBER, GUM  
AND  
RESIN PLANTS

1116 - Experiments with Hevea in the Dutch East-Indies. — I. ARENS, P. E. (Proefstation Malang), Eenige aan de praktijk ontleende cijfers omtrent den invloed van het uitdunnen op de productie van Hevea-tinnen. *Archief voor de Rubbercultuur in Nederlandsch-Indië*, Vol. I, No. 4, pp. 234-240. Batavia, 1917. — II. BISHOP, O. F., GRANTHAM, J. and KNAPP, M. B. (Technical Department, Holland American Rubber Company), Probable Error in Field Experimentation with Hevea. *Ibid.*, No. 5, pp. 335-362.

I. — In the first paper figures are given as to the effect of thinning out Hevea fields on the rubber-yield per acre.

In the first case, in three fields planted 12' × 24' one alternate row was taken away in the course of one month thus bringing the distance to 24' × 24'. Though half the trees were removed the yield of these fields did not show any decrease. The average production per field and per tapping-day during the three months preceding thinning out had been 4.28 lb. and that during the three months following thinning out 4.12 lb., whilst the figures for the three control-fields for the same periods were 3.33 lb. and 3.17 lb. The decrease in yield is the same in both cases and is not due to thinning out.

In the second case, one field 12' × 12' was thinned out to a distance of 24' × 24'. The trees which had to be taken out were pollarded and the stems tapped for one month. During this time the permanent trees were rested. After one month all the pollarded trees were uprooted and tapping was resumed on the permanent trees. The average yield during the two months before thinning out was 2.95 and that during the two months following thinning out 2.71 lb. per tapping day. The same figures for the control-field were 2.89 and 2.61 lb. In this case also no decrease in yield, due to thinning out, took place, notwithstanding the fact that 3/4 of the trees had been removed.

II. — In field experimentation with rubber great care must be taken in interpreting results because of the variations that occur in the yield of equal sized plots of rubber even when similarly treated.

Previous papers are quoted (1), in which it is shown that normal va-

(1) COOMBS & GRANTHAM, Field Experiments and the Interpretation of their Results, *Agricultural Bulletin of the Federated Malay States*, April, 1916; WOOD & STRATTON, The Interpretation of Experimental Results, *Journal of Agricultural Science*, III, 4, 1909; BETCH, The Art of Rubber Experiment, *Tropical Agriculturist*, February, 1915. (Ed.)

riations in yields of experimental plots can be allowed for by the use of a single numerical quantity called the "probable error". The smaller the probable error the greater the degree of precision with which results can be interpreted. Increasing the size of experimental plots beyond a certain limit does not decrease the probable error. Further reduction can only be obtained by duplication of plots. To establish a probable error, records of yields from a large number of similarly treated plots over a period of at least one year are required. A probable error may also be established from records of a large number of groups of plots, provided that the plots comprising each group have been similarly treated. The minimum size of plot is ascertained by calculating a series of probable errors for plots of various sizes. The peculiarities of the rubber crop may introduce certain inaccuracies if a probable error is to be applied generally. It can only be settled by experimentation whether such inaccuracies are of sufficient magnitude to render inadmissible the application of a standard probable error for rubber.

In the absence of a standard probable error, the probable error for a particular experiment can be worked out where duplications exist. WOOD and STRATTON have found that the probable error for annual agricultural crops may be taken as 5 %. It may be inferred, from the experiments discussed in the paper, that a probable error for rubber will not be greater than 7.5 % in carefully selected plots each containing at least 100 trees, but more information is required before generalisations can be made. The same authors found also  $\frac{1}{80}$  acre to be the minimum size of plot for annual agricultural crops. No definite evidence is available regarding the minimum size of plot for rubber, but it will certainly be much larger. It may even prove to be several acres.

Actual records are given showing the variations which may naturally occur among even the most carefully chosen experimental plots and the danger which may arise in attempting to interpret the results of an experiment, although preliminary records are available, unless a probable error is applied.

An example is given of the application of the probable error method to a series of 26 tapping experiments which were carried out in triplicate. They were not planned with the idea of applying the probable error method, and present some difficulties; but a good illustration is afforded of how the method can be applied to previous work where duplications exist.

1117 - **Investigations into Different Methods of Tapping and their Influence on the Yield of the Rubber Plants, in Sumatra.** — RUTGERS, A. A. L., in *Mededeelingen van het Algemeen Proefstation der A. V. R. O. S., Rubberserie* No 10, pp. 19-33 + 5 Tables + 2 Figs. Batavia, 1918.

The experiments described were carried out in the Dutch Indies to determine the most economical method of tapping. Two factors have to be taken into consideration — the destruction of the bark and the healing. It has not yet been found possible to counterbalance these two factors. The healing is always unsatisfactory. During several years the author measured the cortical thicknesses in different plantations and found the

thickness of the bealed bark to be always from 1 to 2 mm. less than that of the original bark, that of a bark scarred twice 1 to 2 mm. less than that of bark scarred once, and so on. For this reason attempts are being made to make smaller and fewer incisions whilst still keeping the yield constant.

RESULTS. — 1) An eight and a nine year old plantation which had been subjected to two incisions on a third section, were subjected to one incision on a third. The productions on one of the plantations remained normal, but on the other it first dropped 25 % and, six months later, rose to normal again. This 25 % decrease agrees with that found by other workers (SPRING). It may, therefore, be concluded that the one incision system is superior to the two incisions system since a 50 % decrease in the bark consumed only causes a 25 % decrease in the rubber obtained.

2) The second experiment compared the system of two oblique incisions on a quarter section at the left of a *straight* central channel with that of two oblique incisions on a quarter section communicating in such a way as to give the central channel a *broken* appearance. The results showed the second method to give a yield exceeding the first by 12 %.

3) A comparison of the results obtained with the different systems of tapping showed the yields obtained from 1 cut on a quarter section, 1 cut on a third section and 2 cuts on a quarter section, to be in the following ratios — 100 : 105 : 121.

4) The last experiment was made to compare the effects of daily tapping with those of tapping every other day (with the same system of incision). Tapping every other day gave a yield 30 % below that obtained with daily tapping, but gave an "economy in bark" of 38 %.

These results are certain to increase the tendency to reduce the cuts, and the author believes that, within two years, in the eastern coastal districts of Sumatra nearly all the plantations will have adopted the system of cuts on a third or on a quarter section.

1118 — *Essential Oils from Cyprus*. — See No. 1075 of this Review.

1119 — *Plants Suitable for the Extraction of Thymol*. — See No. 1075 of this Review.

1120 — *Tobacco Growing in Cyprus*. — See No. 1075 of this Review.

1121 — *Hyoscyamus muticus*, the "Mountain Hemp" of Egypt, the Sudan and India as a Source of Atropine. — See No. 1075 of this Review.

1122 — *Squills (Urginea Scilla) and Liquorice (Glycyrrhiza glabra) in Cyprus*. — See No. 1075 of this Review.

1123 — *Leucaena glauca*. — Department of Agriculture, Ceylon, Leaflet, No. 7, 4 pp. Colombo, January 6, 1918. — *The Planter's Chronicle*, Vol. XIII, No. 11, pp. 201-203. Bangalore, March 16, 1918.

This plant is a small leguminous tree, native of Tropical America, at present growing wild all over the Nilgiris and other hills of South India and acclimatised in many parts of the low country of Ceylon. In Coorg it has been used successfully as a shade tree for young coffee.

It is common in Java, up to 4 000 feet and is used as shade for coffee and for fuel; it is abundant throughout the whole of the low country of Mau-

STIMULANT,  
AROMATIC,  
NARCOTIC  
AND  
MEDICINAL  
PLANTS

VARIOUS CRO

ritius, Reunion, and many parts of Madagascar, being used for fuel and fodder. In the Philippines also it appears to have spread within recent years and is reported as being used there for planting in wild grass lands and as light shade for forest plantations.

*Leucaena glauca* has been used for some years on the Experiment Station, Peradeniya, as a green manure for rubber, and has been regularly cut 4 to 5 times a year with the object of adding humus to the soil. The average quantity of green material per acre per year has been found to be : first year after planting 29 000 lb., second year 77 000 lb. (5 cuttings), and third year 91 900 lb. (6 cuttings). Under these conditions it is kept at an average height of 2 ft.

In Java it is likewise used as a green manure plant. It is commonly employed in young coffee and rubber plantations up to 3 500 feet, and has been experimented with in tea. It is lopped every 3 to 5 months and gives a fair quantity of green mulch per acre. As a green manure in young rubber it was found to be sometimes rather difficult to establish, but where a good cover has been obtained it has stood frequent cutting well, and does not appear to suffer from spells of dry weather. It is used in Java as a light shade for *Robusta* coffee and is being similarly employed at the Peradeniya Experiment Station. It seems to be well suited for this crop. These shade trees are allowed to grow to about 10 feet in height, and they are lopped twice a year, the loppings being mulched around the coffee trees.

In Mauritius, where the plant grows wild over extensive areas of land it is coppiced regularly every year or every alternate year for fuel.

Cattle are very fond of the leaves of *Leucaena glauca*, and in some places herds of goats are housed and fed solely upon leaves of this plant with the object of producing manure. The leaves are rich in nitrogen and potash salts, as the following analysis shows:—ash, 9.26; nitrogen, 2.52; potash, 2.38; phosphoric acid, 0.45 per cent. The seeds are also a valuable food, rich in nitrogen, and may be fed to cattle, sheep, or goats. It should, however, not be fed to horses, as it causes an irritation of the skin, with subsequent loss of hair from the mane and tail, and sometimes coat. Analysis of the seed gave the following average results:—

	Ceylon By agricultural Chemist.	Mauritius By P. BONAME
	Per cent.	Per cent.
Water . . . . .	4.50	9.59
Ash . . . . .	4.55	3.69
Woody fibre . . . . .	14.50	14.00
Fats . . . . .	6.40	4.84
Non-nitrogenous matter . . . . .	40.11	38.24
Nitrogenous matter . . . . .	29.94	29.64
Nitrogen . . . . .	4.79	4.74

The outer coat of the seed is very tough, and forms 50 per cent of its weight. Laboratory tests were made by BONAME in Mauritius in 1897,



when he separated the seed from the seed coat and then analysed them. The results were as follows:—

	Meal from inner part of seed.	Husk.
	Per cent.	Per cent.
Water . . . . .	11.44	12.58
Ash . . . . .	4.78	3.42
Woody fibre . . . . .	7.80	13.90
Non-nitrogenous matter . . . . .	37.09	55.03
Nitrogenous matter . . . . .	31.87	11.87
	100.00	100.00

On account of this hard seed coat, it is usual in practice either to boil the seed until the seed coats burst or to crush the seed dry in an ordinary seed crusher. The latter practice is generally recognised in Mauritius as being the more satisfactory, and is in agreement with the general practice of feeding cattle with dry food rather than with mashes or slops.

In the Philippines it is recorded that *Leucaena glauca* has been successfully used by forest officers against illuk (*Imperata arundinacea*) for it is quick growing and eventually shades the illuk sufficiently to kill it out effectively. It is also used to provide shelter for seedlings in forest plantations. The young forest trees are afforded a light shade by *Leucaena glauca*, and when they have attained a fair size it is cut out and used as fuel. Actual figures are available from the Philippines as to the quantities of fuel yielded by this tree. Experimental plots have yielded average returns of 10 cords (nearly 50 cubic yards) of fuel per acre per year. The wood has a high calorific value, and it is considered to be a high class fuel wood. It has a straight grain, and splits easily (1).

In Java it is reported that plantations of this plant are being made for fuel purposes.

*Leucaena glauca* is also known as a soil renovator. It is the general experience in all countries that soil under this plant subsequently taken into cultivation is of good fertility, and there are instances of poor land being improved by being allowed to remain for some years under it.

#### 1124 — Chemical Composition of the Loganberry (*Rubus Idaeus Loganii*).

— DAUGHTERS, M. R. (Assistant Professor of Organic Chemistry), in *Oregon Agricultural College Experiment Station Bulletin*, No. 151, 10 pp. + 5 Tables + Bibliography of 36 Publications. Corvallis, Oregon, 1918.

HORTICULTURE

After describing shortly the growing economical importance of the loganberry (2) in the United States, the author gives the results of several analyses of the fruit, juice and pulp. The percentages obtained for the fresh fruit were: — Total dry matter 20.74; moisture 79.26; anhydrous citric acid 1.52; invert sugar 7.15; protein (N × 6.25) 4.55; fat 6.13; crude fibre 1.38; ash 0.57.

(1) From the roasted and crushed seeds is made a good coffee substitute (*Revue agricole de l'île de la Réunion*, series X, Year V, No. 12, pp. 344-346. Saint-Denis, December, 1917). (Ed.)

(2) See R., Nov. 1910, p. 79. (Ed.)

The principle acid of the fruit is, therefore, citric acid; there are traces of tartaric acid but malic acid is absent. The pulp which remains after the juice has been extracted may be put to various uses. It may be made into jam or gives an excellent jelly (it is very rich in pectin).

Its use as a food for animals has also been considered, but in this case it would be necessary to neutralise its marked acidity by a suitable addition of sodium carbonate. This pulp may also be used as a fertiliser for, not only does it enrich the soil in organic matter, but also supplies it with a relatively large quantity of mineral matter (phosphorus 1.01 %; sulphur 0.47 %, *ABERN*). Finally when dried, crushed and extracted with petroleum ether, the pulp gives a drying oil the physical and chemical properties of which closely resemble those of linseed oil.

**1125 — A Contribution to the Chemical Composition of Pineapple and the Materials Necessary to its Cultivation.** — GONÇALVES DE SOUSA, J. V., in *Revista Agronomica*, Year XIII, Ser. 2, Nos. 1-4, pp. 26-31 + 9 Tables. Lisbon, 1918.

This paper gives the results of analyses of — a) several samples of pineapple fruits and plants; b) two samples of mould in which the fruit had been grown; c) different materials used for forming the cultural layer ("mata verde, leiva virgem", "mato fermentado, leiva fermentada") which contains *Calluna vulgaris* Salisb., *Erica azorica* Hochst., *Myrsine africana* L., etc.

**ANALYSIS OF THE WHOLE FRUIT:** — Moisture 86.78 %; fat 0.11 %; protein 0.8 %; fibre 0.62 %; ash 0.44 %; ternary extract 11.22 %. A detailed analysis of the ash showed the potassium content to be 0.196 %, a content superior to that of the other minerals.

**ANALYSIS OF THE MATERIALS USED FOR CULTIVATION** (layer, mould, etc.) These results confirm those obtained by the analysis of the fruit and the plant, *i. e.*, that this plant requires above all large quantities of potassium and nitrogen in the form of nitrogenous organic matter.

Assigning to each fruit an average weight of 2 kg. (4.4 lb.) and a weight of 2 kg. to each plant as well, the amount of food extracted from the soil by each thousand plants was; nitrogen 8.1 kg.; phosphoric acid 0.84 kg., potassium 17.50 kg., lime 2.68 kg.

## LIVE STOCK AND BREEDING.

### HYGIENE

**1126 — Immunity Studies on Anthrax Serum (1). Transformation of Pseudoglobulin into Globulin.** — I. EICHORN, A., BERG, W. N. and KESLER, R. A. (Pathological Division, Bureau of Animal Industry, U. S. Dept. of Agr.), in *The Journal of Agricultural Research*, Vol. VIII, No. 2, pp. 37-56 + 6 Tables + 1 Fig. + Bibliography of 11 Publications. Washington, D. C., January 8, 1917. — II. BERG, W. N., *Ibid.*, No. 12, pp. 449-456, March 19, 1917.

I. — The immunity conferred by anthrax serum is of short duration, lasting only a few weeks. To produce a more lasting immunity SOBERN-

(5) See also R. May 1918, No. 543. (Ed.)

HEIM recommended a simultaneous treatment with serum and vaccine. EICHHORN obtained good results from the use of serum and spore vaccine and found the method to possess advantages over the PASTEUR method. Numerous experiments undertaken demonstrated the value of anthrax serum as a curative agent and as a prophylactic when employed simultaneously with anthrax spore vaccine.

Recalling the work on the separation of diphtheria antitoxin by fractioning the serum through the use of ammonium sulphate, the writers applied this method to anthrax serum and succeeded in producing the antibodies in a concentrated form. Chemical analyses of the serum and globulin preparations were made, and the changes in serum proteins during the course of hyperimmunisation of animals against anthrax were studied with the following results:—

Anthrax serum was fractioned by the methods used in the preparation of diphtheria antitoxin. The anthrax antibodies were associated with the pseudoglobulin fraction.

The globulin preparations contained the antibodies in a concentrated form. This was shown in numerous tests on laboratory animals. The preparations were also potent in tests on larger animals, that is, cattle, horses, etc. When administered to human beings infected with anthrax, the globulin preparations were found to have great therapeutic value. However, no data have yet been obtained which permit accurate measurement of the potency of either the serum or the globulin obtained therefrom.

The methods of analysis of serum and similar preparations of globulin have been improved by the use of the centrifuge instead of filtration as a means of separating globulin precipitates from their filtrates. The precipitates are obtained in compact form with a minimal amount of absorbed supernatant fluid. There is no need for reprecipitation.

The changes in the amounts of the serum proteins in a mule undergoing immunisation to anthrax were similar to those usually noted in the serum of animals being immunised to diphtheria, tetanus and rinderpest, that is, there was a pronounced rise in the content of total coagulable protein and total globulin.

Favourable results follow the use of anthrax serum or globulin preparations in the treatment of anthrax in man or animals. The globulin preparation is probably superior to the serum in the treatment of the disease in man, since the dose is smaller, and may be safely given intravenously, and the danger of anaphylaxis is minimised.

The work on the standardisation of anthrax serum by complement fixation, while still in an experimental stage and incomplete, points to the possibility of a more accurate means of standardisation through its employment.

II — In several publications BANZHAF states that when diphtheria serum is heated as it is in the preparation of antitoxin, part of the pseudoglobulin is transformed into globulin. This transformation has both a practical and a theoretical interest. It facilitates the concentration of the antitoxin present in the serum by removing protein without removing any

of the antitoxin, so that the final product contains all the antitoxin associated with much less protein. This is desirable because certain of the serum proteins have very little therapeutic value. On the theoretical side, the fact that pseudoglobulin can be transformed into euglobulin without affecting the total number of antitoxic units is almost conclusive proof that the antitoxin is a substance separate from pseudoglobulin. That this transformation may take place in some serums, but not in all, is indicated by the experiments which the author describes in the paper under review. The writer has applied the heat treatment to the anthrax serum, with the following results:—

The transformation of pseudoglobulin into euglobulin was observed in four serums that had been heated for 30 minutes at 60° C. in the presence of 30 per cent saturation ammonium sulphate. In some instances the amounts transformed were considerable, although in one of the serums the amount was so small as to indicate that the transformation does not take place in all serums.

The methods of analysis were improved by the use of the centrifuge as a means of separating globulin precipitates from their filtrates. The precipitations in the analyses were made at the same dilutions as in the precipitations of globulin for therapeutic use.

**1127—On the Possibility of the *Post Mortem* Generalisation of the Virus of Rabies.—**

REMLINGER, P., in *Comptes Rendus de la Société de Biologie*, Vol. LXXXI, No. 11, pp. 564-566. Paris, June, 1918.

Objection has often been made to those authors who have recorded the presence of the virus of rabies in various organs that their *post mortem* researches should be accepted with caution, since the virus might become generalised after death, either by a sort of multiplication or by a kind of diffusion somewhat similar to that of a dissolving chemical substance. Thus, after finding that the virus diffuses *in vitro* (in physiological salt solution, in Locke's solution, etc.), the author attempted to ascertain whether an analogous phenomenon could take place *in vivo*. He thus attempted to find an answer to the following questions:—

1) *Can the virus of rabies be found, owing to the on-set of putrefaction, in an organ (testicles, seminal vesicles, ovaries) (1) where it can be found neither during life, nor during the first hours after death.*

Experiment gives a negative answer to that question.

2) *Given an organ (suprarenal capsules, spleen) where the presence of the virus is inconstant, does the frequency with which it is found vary according to whether the organ was removed before or after the death of the animal?*

The reply provided by the researches is again negative, or at least it may be said that, according to the two cases, there is very little difference as regards the frequency with which the virus is found.

The author concludes that the *post mortem* generalisation of the virus of rabies is very rare and inconstant; that, in consequence, researches undertaken without taking such an eventual generalisation into account

(1) See R., August, 1918, No. 878. (Ed.)

would not be burdened with an appreciable source of error. The diffusion of the virus *in vivo* is less frequent than that taking place *in vitro*. The author suggests, as the simplest explanation of this fact, that a liquid lends itself better than a solid to "diffusion", which taken as a whole is fairly close to 'dissolution'.

**1128—Efficacy of Some Anthelmintics.** — HALL, M. C. and FOSTER, W. D. (Zoological Division, Bureau of Animal Industry, U. S. Dept. of Agriculture), in the *Journal of Agricultural Research*, Vol. XII, No. 7, pp. 397-447 + Bibliography of 30 Publications. Washington, D. C., February 18, 1918.

Although the use of anthelmintic treatment is an old practice, the efficacy of the various substances employed as anthelmintics is not well known. The available information is based largely on clinical observations or on faecal examinations for worms passed and for eggs persisting in the faeces, which method is somewhat inexact. A more satisfactory one is to treat the animals, collect all the faeces passed for a number of days, and recover from them all worms present, and then to kill the animals and collect all worms remaining. This was the method employed by the authors. Their plan was to test as many drugs as possible having a known or alleged anthelmintic value, abandoning those which gave no results, and making further experiments with the more promising ones. The results are summarised in 5 tables, and, making due allowance for the paucity of data in regard to certain drugs, the writers consider that the following may be reasonably advanced as the result of their investigations.

Simple purgatives, calomel and castor oil, may have some slight value as anthelmintics, but it is hardly sufficient to justify their use for this purpose. Ascarids (*Belascaris marginata*) in dogs are sometimes removed by castor oil given as a preliminary purge, and this fact may prove of benefit in veterinary practice as a diagnostic measure when the more accurate method of microscopic faecal examination cannot be carried out. However, castor oil failed to remove ascarids more frequently than it succeeded, and in no case were all the ascarids removed from any one animal. As many of the experiments on dogs were preceded by a dose of castor oil, the writers have fairly extensive data on this subject.

The most reliable vermifuge for ascarids, whether in dogs or swine (*Ascaris suum*), is oil of chenopodium. This drug, which was tested on 34 dogs in 6 experiments, showed an efficacy for the entire series of 97 per cent. It rarely fails to remove all the ascarids present in a dog if given at the rate of 0.2 mil (milliliter) per kilo, preceded by a dose of castor oil and the animal starved for 24 hours before treatment.

The chenopodium treatment is also very efficacious for ascarids in swine, and when properly administered may be expected to remove most, if not all, of the worms present. It would seem, however, that neither chenopodium nor any other drug tested will give satisfactory results if mixed with the daily ration and the animals allowed to dose themselves; it is best given to each pig individually in suitable dosage, preceded by a fast.

Oil of chenopodium appeared to be effective for stomach worms in sheep

(*Bunostomum trigonocephalum*) although the data on this subject are not sufficient to warrant its recommendation. It is also of some efficacy for hookworms in sheep and in dogs (*Ancylostoma caninum*) though in the latter case chloroform was found more reliable.

Other remedies which seem to have more or less merit as anthelmintics against ascarids are the latex of *Ficus laurifolia*, santonin in repeated doses, and thymol. Although thymol in repeated doses is fairly efficacious against hookworms, it was inferior to chloroform for this purpose, causing more distress. An excellent preparation for mixed infestation in dogs consists of equal parts of oil of chenopodium and chloroform, given at the rate of 0.2 mil per kilo, combined with 30 mils of castor oil. This preparation may be expected to remove all the ascarids present, a large proportion of hookworms, and possibly a certain percentage of whipworms. This latter parasite seems to be very difficult to eliminate, and nothing tried by the writers proved very efficacious, almost any anthelmintic occasionally proving successful. This experience may perhaps be explained by an intermittent peristalsis of the caecum, which occasionally allows the anthelmintic to enter, but which usually excludes it. Although chloroform was fairly successful in removing stomach worms from sheep, both animals upon which it was tried subsequently died from its effects, and it would seem to be too dangerous for use on sheep.

In the case of stomach worms in sheep, copper sulphate (1 % solution ; 100 mils to sheep a year old, 50 mils to lambs under a year old) was found to be the most satisfactory remedy, the experiments confirming the findings of HUTCHINSON. Petroleum benzine also proved satisfactory and was more efficacious for hookworms than copper sulphate. However, it is much more expensive than copper-sulphate solution, must be given three times, and in a vehicle like milk, which adds greatly to the expense. The fact that petroleum benzine (refined gasoline) proved efficacious, while commercial gasoline was considerably less so, is perhaps related to the differences in specific gravity and consequent volatility of the refined product compared with the commercial product.

Among anthelmintics intended for use against tapeworms, male-fern (*Dryopteris filix-mas*) proved efficacious when tested on dogs. In the case of cats it removed all tapeworms from 75 per cent of the animals tested, though it proved fatal to 2 out of 6 animals which were somewhat enfeebled from disease. Apparently it is more toxic to cats than dogs and should be prescribed with caution and only given to healthy subjects. So far as can be judged from a single experiment with dogs, there seems to be no danger in combining male-fern with castor oil, as is done in the so-called Hermann's mixture. In fact, the writers are inclined to agree with SEINFERT (1908) that the administration of castor oil after male-fern will avoid the toxic effect of the latter by causing its rapid and thorough elimination, and that for this purpose no other purgative is quite so effective. This subject, however, should receive more study before conclusions are drawn. Pelletierine tannate was a failure in the one experiment in which it was tested on cats, but was efficacious on dogs. No remedy was efficacious

against tapeworms in poultry. Of the four drugs tested, chenopodium gave the best results for this purpose, but its efficacy for tapeworms is very slight.

Turpentine proved the most efficacious of the remedies tested on poultry for the removal of *Ascaridia perspicillum*, while chenopodium was nearly as good. When tested on dogs and pigs, turpentine was not very efficacious; and, as it caused grave symptoms of nephritis in pigs and caused the death of some of the experiment dogs, its use upon these animals is inadvisable.

The treatment with chopped tobacco stems recommended by HERMS and BEACH for ascarids in poultry proved fairly efficacious for *Heterakis papillosa* and would presumably be at least as efficacious for *Ascaridia perspicillum*, since this latter worm is more easily reached by anthelmintics than is *H. papillosa*.

There are a large number of drugs showing a greater or less degree of efficacy for the various intestinal parasites of domestic animals. Usually their action is selective — that is, they show a pronounced efficacy for certain species of intestinal worms, while they are decidedly less efficacious or entirely inefficacious against other intestinal parasites. If we consider that the ideal anthelmintic is one which will remove all worms of a given class or species, and do this every time in a single dose, we find that very few drugs approach this ideal.

Among the drugs which have given the best results under experimental conditions for the purposes intended and concerning which the writers have sufficient data to warrant positive conclusions may be mentioned the following:—

- 1) Copper sulphate in drench for stomach worms in sheep.
- 2) Oil of chenopodium for ascarids in pigs and dogs.
- 3) Oleoresin of male-fern for tapeworms in dogs.
- 4) Turpentine for *Ascaridia perspicillum* in fowls.
- 5) Chopped tobacco stems for *Heterakis papillosa* in fowls.

#### 1129 - The Destruction of Ticks Found on Domestic Animals in New Zealand. —

REAKES, C. J. (Director, Live stock Division), in the *New Zealand Department of Agriculture, Industries and Commerce, the Journal of Agriculture*, Vol. XVI, No. 2, pp. 83-86. Wellington, February 20, 1918.

Ticks have been found to be unusually prevalent upon cattle, dogs, horses, and occasionally sheep, in portions of the northern Auckland district of New Zealand but their presence does not imply the existence of piroplasmosis (tick-fever), which has never been present in the Dominion. Two ticks have been found — *Ixodes ricinus* (dog-tick, or castor-bean tick) and a species of the subfamily known as *Hæmaphysalis*.

Each year these ticks are first noted about August and September and they are most numerous in November and December. During January their numbers diminish, and between February and August little of nothing is seen of them.

As long as tick fever is kept out of the Dominion there will be nothing to fear from the ticks on that score; but, if they become too numerous they

may cause trouble: — *a*) by lowering condition through loss of blood; *b*) by decreasing the milk-yield; *c*) by deteriorating the value of the hides; *d*) by causing death in animals already weakened by other diseases, insufficient food, etc.

The officers of the Livestock Division have experimented with methods for destroying the parasites, and found that, in the case of dairy cows and other cattle which can be handled, spraying with Stockholm tar is an effective method, as the ticks are killed by it in a few hours. As regards run cattle, unaccustomed to handling, dipping is the only effective method available. The tar is sprayed on the infected parts of the skin by means of the "Faultless" spray-pump, which is quite cheap and was originally sold for spraying garden plants, etc.

Other spraying preparations tried were as follows: —

- 1) Kerosene  $\frac{1}{2}$  pint, linseed-oil  $\frac{1}{2}$  pint, sulphur 1 oz.
- 2) Kerosene 10 oz., lard 10 oz., tar 2 oz., sulphur 1 oz.

These two mixtures, however, though they ultimately destroyed the ticks, proved much slower in their action than the Stockholm tar. Very strong solutions of sheep-dips also proved effective, but sometimes irritating to the animals.

**1130 — On a Mite of the Genus *Tyroglyphus*, an Accidental Parasite of the Horse.** — CARFANO, M. (Bacteriological Laboratory for Military Veterinary Medicine, Rome), in *La Clinica Veterinaria*, Year XLI, No. 7, pp. 173-177 + 1 Fig. Milan, April 15, 1918.

In the crusts and hairs removed from quadrupeds suspected to be suffering from mange, besides the mites parasitic on other animals (obligatory, stationary, permanent parasites) belonging to the family *Sarcoptidae*, sub-family *Sarcoptinae* (with the 3 genera *Sarcoptes*, *Psoroptes*, and *Chorioptes*) and to the family *Demodecidae* (genus *Demodex*), other mites may be found as temporary parasites such as those of the family *Gamasidae*, the common parasites of poultry, and other insects (accidental parasites) incompletely determined which normally live on seeds, forage, old wood, sweepings, etc. Amongst these latter, some species of the sub-family *Tyroglyphinae* of the family *Sarcoptidae*, are of interest, either because they may be mistaken for the common mites truly parasitic on the horse, or because, as is the author's opinion, they can, under determined conditions, exercise a certain pathogenic action on the horse.

Some of these species normally live on vegetable and animal organic matter, usually decomposing, and on which they feed. Others are parasites of the larvae of grain-eating insects that infest all kinds of cereals and other food-stuffs. These mites may attack man, causing skin irritation sometimes accompanied by fever ("vanillismus" of workers handling vaniline; "water itch" of the Indian tea planters; grocer's itch; harvest fever; etc.). Veterinary pathology has shown the possibility of finding specimens of *Tyroglyphinae* on the skin of animals, but, as far as the author is aware, there has yet been no record of the possibility of their causing a pathogenic action on the skin itself.

The author has seen dermatosis on the lips, spreading to the cheeks



and nose of the horse, produced by mites of the genus *Tyroglyphus*, which he describes and illustrates. These accidental ectoparasites probably come from fodder. They can be distinguished from the true mange mites by 1) their elongated body; 2) the clear division between the cephalo-thorax and abdomen; 3) the absence of striae on the body; 4) all the 4 legs being uniform and provided with suckers.

1131 - Experiments on the Treatment of "Tristeza" in the Argentine. — QUEVEDO, J. M., in *El Campo*, Year II, No. 219, pp. 267-268 + 2 Figs. Buenos Aires, May, 1918.

The author (Sub-Director of the Bacteriological Institute of the Ministry of Agriculture of the Argentine Republic) calls attention to the fact that "tristeza" occurs in two forms — piroplasmosis or babeosis, caused by *Babesia bigemina*, and anaplasmosis, caused by *Anaplasma bovis* (1).

PIROPLASMOSIS. — Quinine compounds, and especially the bichlorhydrate, on account of its solubility, stimulate the secretions of the sick animal, which helps greatly towards recovery, but they neither decrease the numbers of the parasites nor cause any notable modification in their structure. For grave cases the author advises intravenous injections of 5 to 8 gm. of bichlorhydrate of quinine dissolved in 25 to 40 cc. of water, or 10 to 20 gm. of quinine sulphate dissolved in  $\frac{1}{2}$  a litre of water given by the mouth; the doses can be given after every 24 hours. Fractional doses, when given immediately when the first symptoms of the disease appear, may give good results with the slowly-developing forms. Other febrifuges (e. g., antipyrine) did not give as good results as quinine.

Amongst arsenical compounds, sodium cacodylate, arrhenal and atoxyl have been repeatedly tested by the author, who has found that though they act favourably they have no decisive influence on the course and issue of the disease.

During the acute period, colloidal silver (lichtargan, collargol, protargol) reduce the temperature, but have no decisive influence on the course of the disease.

Aniline dyes, and especially trypan blue, were found to be decidedly efficacious against the parasite. Trypan red has also given good results, while safranin and neutral red were less successful.

Salts with a purgative action, such as magnesium sulphate, are always useful in the treatment of bacteriosis. Stimulants (coffee, etc.) are also useful.

During the course of the disease, fresh forage, roots and decoctions should be given, while the grain and hay should be restricted.

ANAPLASMOSIS. — Trypan blue, trypan red and the other aniline compounds that are efficacious against piroplasmosis are inefficacious against anaplasmosis. Slightly better results have been obtained with a single dose of 3 to 4 gm. of atoxyl injected in the jugular. Very poor or worthless results were obtained with salvarsan (2 gm. injected in the jugular) and colloidal silver. Opening medicine and febrifuges are useful.

(1) According to other authors these are two phases of the same disease. See R., July, 1918, No. 777. (Ed.)

In conclusion, there are no therapeutic agents that suffice to combat anaplasmosis.

**1132 — Two Flukes from the Dog.** — HALL, M. C. and WIGDOR, M. (Research Laboratory, Parke, Davis & Co., Detroit, Mich.), in the *Journal of the American Veterinary Association*, Vol. LIII, New Series Vol. 6, No. 5, pp. 616-626 + 7 Figs. + Bibliography of Publications. Ithaca, N. Y., August, 1918.

Up to the present the only fluke reported from the dog in the United States is *Paragonimus kellicotti*, which occurs in the lungs of dogs, cats and swine. The authors made a post mortem examination of 300 dogs at Detroit, and found intestinal flukes in 7 animals. The flukes belonged to 2 different species, which are new to science, and which the authors name *Alaria americana* and *A. michiganensis*, the specific diagnosis being also given.

#### FEEDS AND FEEDING

**1133 — Albuminoids in the Feeding of Live Stock.** — WIEGNER, G. (Contribution from the Agrikultur-chemischen Institut der Eidgen. Technischen Hochschule, Zurich), in *Landwirtschaftliches Jahrbuch der Schweiz*, Year XXI, No. 1, pp. 42-64. Berne, 1918.

After considering generally the feeding of cattle the author discusses at length the part of albuminoids therein and shows that, in the new discussion on the minimum quantity of albuminoids necessary in the feeding of man and animals (raised by the shortage of albuminoids and their rise in price through the war) account must be taken to a far greater extent than has hitherto been done of the biological value of the albuminoids, of the qualitative composition of the foods and fodders and the variable degree of digestibility. It is necessary to distinguish between the relative minimum and the absolute minimum of albuminoids necessary in feeding because the physiological laws are not yet known with sufficient exactitude and there is as yet no feeding technique sufficiently trustworthy to make it possible to restrict either men or animals to the "absolute minimum" of albuminoids (which is, for example, 30 gm. for a man and from 100 to 125 gm. for cattle weighing 500 kg.).

The author believes that, even in times of scarcity, the absolute minimum of albuminoids must be doubled if waste of other food elements of great value is to be avoided, and especially if derangement of the organism is to be guarded against. He shows the reasons, based on abundant experimental data, which led him to form this opinion and shows the figures given later to be probably correct for the albuminoid requirement of live stock in so far as our theoretical and practical knowledge of feeding will enable us to judge.

It is possible that the absolute minimum of albuminoid requirement for cattle weighing 500 kg. may be reduced to 100 to 125 gm. of digestible albuminoids in the ration, but most workers agree, and rightly so, that 250 gm. is the minimum amount of digestible albuminoids which should be fed. In a diet requiring the greatest possible economy, as in the case of that imposed by the war, this figure may, at the most, be reduced to 200 gm. of digestible albuminoids in the fodder given.

Under better feeding conditions and with albuminoids of high biological value it is possible to recover, in the form of milk albumin, all the albuminoids fed, in addition to that which is indispensable to the main-

tenance of the dairy cow. It is also possible in practice and under the experimental conditions adopted by the author, to cause 350 gm. of digestible albuminoid contained in a ration to be transformed into 350 gm. of albumin contained in 10 litres of milk with a 3.5 % albumin content. KELLNER, however, recommends under the same conditions almost a double quantity, that is to say 550 to 650 gm. of digestible albuminoids for 10 litres of milk.

If, instead of considering the starch value only, account is taken of the qualitative composition of the food according to the rules given in this paper, the quantity of albuminoids required to produce 10 litres of milk may be reduced to 450 gm. FINGERLING believes it possible to reduce this figure to 400 gm., but, as the author justly points out, it is precisely in feeding for milk production that a limited excess of albuminoids most rarely represents a wastage of albuminoids. Growing animals can also transform a quantity of albuminoids exceeding that which is indispensable for maintaining the albumin which accumulates in the tissues of the animal providing, of course, that this is under improved conditions of feeding and development such as specified by the author. As these conditions are very difficult to realise in practice the author recommends that, in this case too, the figure given for the absolute minimum be doubled.

For growing calves the author recommends in time of war demanding the greatest possible economy the following figures drawn up by FINGERLING: —

Age of animals  <i>months</i>	Live weight  <i>kg.</i>	Minimum quantity required for 1000 kg. of live weight	
		Digestible albuminoids in maintenance ration  <i>gm</i>	Digestible albuminoids in fattening or production ration  <i>gm</i>
2-3	70	400	2 200
3-6	140	400	1 800
6-12	240	400	1 300
12-18	320	400	800
18-24	400	400	600

These rations must be considered as "minimum war rations"; their values are 25 % below those given by KELLNER.

The amount of albuminoid necessary for growing pigs has not yet been fixed definitely and new investigations are necessary. The author's calculations, however, show that, for growing pigs, the minimum quantity of digestible albuminoids is from 60 to 80 gm. per head daily, though according to FINGERLING an average quantity of 30 to 40 gm. is sufficient. It is known that pigs under good growing conditions respond well to albuminoids in the ration.

For a complete ration (maintenance ration + production or fattening

ration) LEHMAN recommends 250 to 300 gm. of digestible albuminoids per head daily, whereas FINGERLING reduces these figures to 100 to 200 gm. By numerous practical experiments on the intensive and rapid fattening of pigs (from 20 to 110 kg. in 5 or 6 months) LEHMAN showed that the rather large quantity of albuminoid he advises gives good results and proves profitable though admitting that when necessary it may be decreased to 200 gm. as shown by the author.

The author also shows that a ration deficient in albuminoids may often cause serious derangements, especially in growing pigs. In view of the uncertainty of calculating theoretically the quantity of albuminoids to be given to pigs he recommends the use of empirical rules for feeding which would lead to good practical results and could also be used in war time when the shortage of albuminoids is more keenly felt. Some of these principles and rules for feeding pigs are taken from the works of LEHMAN on this subject.

**1134 - The Treatment of Lupins in Order to Eliminate their Toxic Properties; Researches in Holland.** — BOODT, in the *Tydschrift der Nederlandsche Heideemaatschappij*, Year XXX, No. 3, pp. 68-70. Wageningen, 1918.

Description of a method for removing the poisonous substances contained in lupins:— a vat is half-filled with lupins, then filled up to the brim with water and left to stand for 24 hours. The lupins, which are nearly dry, are placed in another vat full of fresh water, boiled for 3 hours and left to cool for 12 hours. They are again removed to another vat containing fresh water, where they remain for 12 hours; they are then crushed with a wooden mallet. The author admits that the process is not very rapid, and points out that it is necessary to proceed cautiously and safely in order to avoid the slightest trouble in feeding.

When lupins treated in this way were fed to cattle just as they were, their food value was not very great as the greater part of them were found undigested in the faeces. Their digestibility had therefore to be increased, and to obtain this the author mixed them with finely chopped ("hacksel") oat straw. This mixture then formed an excellent food for cattle; about 22 lb per head and per week suffice for working oxen and if they are given no concentrated food stuffs the quantity mentioned may be doubled or tripled. The feeding value of the lupin is obvious when its starch value (74.2 for 100 kg.) is compared with that of the horse-bean (66.6).

**1135 - Vine Fodder: The Value and Utilisation of Vine Leaves.** — SEMICHON, L., in the *Revue de Viticulture*, Year XXV, Vol. XLVIII, No. 1252, pp. 401-406 + 2 Tables. Paris, 1918.

Districts devoted especially to vine-growing are bound to suffer more severely than others during critical periods because most of the necessities of life must be imported. It is, then, especially necessary for the inhabitants to utilise every bit of utilisable matter produced in the district, and above all, in the vineyards. The leaves and shoots of the vine, usually wasted, have a very real food value. The trimming and pruning of the vines during the periods of vegetation and flowering remove a considerable quantity of leaves and young shoots which are left on the soil but which,

if collected, would make excellent fodder for horses and permit of an economy of hay and alfalfa. It would be best to collect the leaves in autumn, after the vintage, as there are then at least 1 lb. (and even 2 or 4 ½ lb.) per plant. Allowing there to be 620 plants per acre, a yield of about 16 cwt. per acre would be obtained, or 5 acres would give enough leaves to feed a horse for one year.

The results of analyses of this material (KELLNER, MALLÈVRE) are given and compared with those obtained for good meadow hay or good alfalfa hay. These results show the starch value (for 100 parts of food) for vine leaves, meadow hay and alfalfa hay to be 42.5, 36.2, 22.4 respectively, i. e., that 90 lb. of vine leaves equal 100 lb. of meadow hay, and 53 lb. equal 100 lb. of alfalfa hay. If this material is not used it is, therefore, because of practical difficulties or other objections, three of which the author examines:

1) *Is stripping off its leaves in autumn injurious to the vine* — Not at all. On estates owning flocks it is customary to let the sheep pass among the vines immediately after the vintage and no weakening of the plants has ever been observed. Moreover, the stripping might be modified to a certain extent. From a point of view of diseases, especially mildew, stripping the leaves is most beneficial as the spores which transmit the disease from one year to another and form in the "mosaic spots" of the autumn foliage, are thereby largely removed.

2) *Does not the collection of the leaves entail practical difficulties?* — Two methods may be adopted: the branches might be cut leaving 5 or 6 buds at the base, the leaves and branches thus being collected together, or only the leaves might be collected. The second method is the more economical as the first is only advantageous if the branches are utilised. If the branches are already lignified they require the use of a mechanical crusher (4 to 5 HP). Their food value is very similar to that of grape stalks, the starch value of which is only 7.7.

3) *Do vine leaves keep well?* — As wine leaves are less moist in autumn than meadow hay or alfalfa, it would be sufficient to pile them up in a shed, as is done with dry fodder. It is, however, wiser to put them in a silo either alone or mixed with residue, piled up well in a tiled pit or in troughs. When the leaves and branches are collected together ensiling is indispensable as the leaves contain more natural moisture than the branches. The profit made, food value and preservation are, thus, all in favour of collecting the leaves only. There is no danger that the action of copper salts which remain on the leaves may injure the health of the animals. Taking into account all the expenses incurred (collecting, ensiling), this fodder would cost 4s. per 220 lb. It is therefore, most economical, especially at a time when hay and alfalfa cost at least 24s. per 220 lb.

1136 — *Tree Leaves in Live Stock Feeding.* — I. I. HOSTE, A., in *La Vie agricole et rurale*, Year VIII, No. 27, pp. 23-24. Paris, July 6, 1918. — II. EZENDAM, F. A., in *Nederlandsch Weekblad voor Zuivelbereiding en Veearts*, Year XXIV, No. 16, p. 2. Doetinchem, 1918.

I. — The author (Director of the Mans slaughter houses, France) shows the value of tree leaves in the feeding of live-stock. The food value of

the leaves varies according to the vegetative period and the plant: as a rule it is higher in June and July than in September, and the leaves from the higher parts of the tree are richer in fibre. The plants containing the most nitrogen are alder, acacia, elm, lime, oak and maple.

The results of several chemical analyses made by M. A. CH. GIRARD (Professor of the Institut national agronomique) are given in detail. The average food value, in food units, of tree leaves at the end of July is 37.7, and that of meadow hay 31.

The leaves may be fed either green or dry. Green and dry leaves may be given to animals in the following quantities respectively:— horses and mules, 11 to 17.6 lb., 8.8 to 11 lb.; oxen, 22 to 33 lb., 13.2 to 22 lb.; sheep, 5.5 to 6.6 lb., 2.2 to 3.3 lb. Various specimen rations are then given:—

*For horses of 1100 lb.* — 1) green leaves 17.6 lb., oats 8.8 lb., straw 4.4 lb.; 2) dry leaves 9.9 lb., oats 11 lb., straw 3.3 lb.

*For oxen*: — 1) maintenance ration: dry leaves 14.3 lb., oat straw *ad lib.*; 2) working ration: dry leaves 22 lb., boiled potatoes 44 lb., rape cake 2.2 lb.

*For cows of 1100 lb.*: — 1) dry leaves 55 lb., straw *ad lib.*; 2) dry leaves 17.6 lb., boiled potatoes 41.8 lb.

*For sheep*: — 1) green leaves 6.6 lb., straw *ad lib.*; 2) dry leaves 3.3 lb., straw *ad lib.*

**TWIGS.** — Twigs with leaves are called "summer twigs", those without leaves, "winter twigs". The true food value in food units is 12.6 for acacia twigs, 13.2 for poplar twigs, 12.9 for beech twigs (negative value because the work of digestion is superior to the number of calories obtained from the food), as against 31 for hay.

Chopped, fermented twigs and non-chopped dry twigs may be fed in the following proportions respectively: — horses and mules 6.6 lb., 8.8 to 13.2 lb.; oxen 16.5 lb., 22 to 26.4 lb.; sheep 1.1 lb., 2.2 to 4.4 lb. The following rations are recommended for oxen and cows:—

1) chopped summer twigs 16.5 lb., chopped straw 6.6 lb., rape cake 4.4 lb.; salt 1.1 lb.; 2) crushed winter twigs 26.4 lb., chopped straw 6.6 lb., potatoes 11 lb., rape cake 1.1 lb., salt 0.22 lb.

**MISTLETOE.** — This may be fed fresh or dry; in the latter case it is chopped. It may be fed in amounts of 4.4 to 6.6 lb. to horses and mules, 4.4 to 13.2 lb. to oxen and 1.1 to 2.2 lb. to sheep and goats. The following rations are recommended:— *for dairy cows*:— mistletoe 13.2 lb., hay 4.4 lb., beet 44 lb., fine straw 4.4 lb., bran 3.3 lb., groundnut cake 3.3 lb.; *for sheep*:— mistletoe 2.2 lb., beet 11 lb., bran 2.2 lb.

II. — According to the author (of the Royal Agricultural Experiment Station of Wageningen, Holland) the food value of dry leaves is about equal to that of medium quality hay. The date and hour at which the leaves are harvested influences their food value. The dry matter content is highest and the nutritive constituents most abundant in July and August. Towards autumn the tannin content increases and digestibility is no longer so good. The leaves are obviously richest in starch in the evening owing to the formation of chlorophyll. Dry leaves must not be exposed to the sun and must be protected from rain. Trees capable of supplying suitable food are

acacia, birch, elm, poplar, lime, chestnut, ash and willow; beech and oak are less suitable.

- 1137 — **Investigations into the Composition of Seaweeds with a View to their Utilisation as Cattle Food, in the Netherlands** (1). — DE BRUYN, B. R. (Director of the Royal Agricultural Station for the Control of Cattle Foods, at Wageningen), in *De Veldbode*, No. 807, pp. 504-505 + 2 Tables. Maastricht, 1918.

In order to utilise all available material in the best possible manner so as to remedy the increasing shortage of cattle food, the Royal Agricultural Station at Wageningen for the Control of Cattle Foods analysed specimens of seaweeds. On a water-free basis, the composition of *Zostera marina* was: — Albuminoids 20.6 %; true albumin 16.9; digestible albumin 4.2; fat 1.6; starch 38.6; crude fibre 14.8; ash 24.4; sodium chloride 12.7 %.

Samples of Fucaceae were also analysed. Their albumin content is not high owing, according to WERENSKIÖLD, to the presence of tannic acid which, with the albumin, forms an insoluble compound on which experiments have shown pepsin to have no action. The experiments of SOLLIED in Norway, and those of the author have not revealed the presence of tannic acid. The food value of the seaweeds must, then, be attributed rather to their starch even though they have not a high carbohydrate content. The low crude fibre content of the *Fucus* is, however, an advantage.

The few known examples of the previous use of seaweeds as cattle food are quoted. In Ireland, Scotland and the Faroë Islands, dried seaweed is used as a winter feed for cattle and horses, in southern Sweden and Zealand as a food for swine. In Germany, since the war, special instructions have been given with respect to the gathering of seaweeds. They are spread out so that the rain can wash out the sodium chloride sufficiently; they are then suitably dried and baled in a press. Washing with soft water is indispensable as many seaweeds (the "brown algae") contain a mucilaginous nitrogenous substance, algine, which with lime and magnesia forms insoluble compounds which would diminish the food value if hard water were used.

In the absence of other roughages, therefore, seaweeds may be fed to cattle when the sodium chloride has been sufficiently removed.

- 1138 — **Various Cakes from Cyprus and Africa, Straw and Hay from Cyprus; Composition and Food Value.** — See No. 1075 of this *Review*.

- 1139 — **Sunflower Pith as a Cattle Food.** — See No. 1075 of this *Review*.

- 1140 — **Cross Between Sheep and He-goat and Between Goat and Ram, in Brazil** (2). — *Chacaras e Quintaes*, Vol. XVII, No. 5, p. 368 and No. 6, p. 466; Vol. XVIII, No. 1, p. 26. São Paulo, May 15, June 15, July 15, 1918.

Senhor OSCAR CANTEIRO reports the existence at Porto Alegre of crosses between sheep and he-goats which are very fine, and have long wool

SHEEP  
AND GOATS

(1) Algae are already being collected in several countries, chiefly for use as fertilisers or as raw material for chemical industry. See *R. Dec.*, 1916, No. 1261 and *R. Jan.* and *Feb.*, 1917, Nos. 91 and 123. As regards their use as cattle food, see *R.*, March 1918, No. 320 and Sept. 1918, No. 1020. (*Ed.*)

(2) See also *R. August*, 1918, No. 889. (*Ed.*)

of the best quality. In view of the long life of these crosses he bred selected sheep to a he-goat of the Toggenburg breed.

According to a correspondent of the periodical *Chacaras e Quintas* of Correntes (Matto Grosso, Brazil) crosses between rams and goats occur commonly in that State. He himself has a small troupe of goats bred exclusively to a ram. The progeny of the cross, locally called "cabrão", have the appearance of kids of a wool breed, but the wool is not curly.

Dr. FERNAND RUFFIER, in his work "*Manual Prático de Criação do Gado no Brazil*", describes the Mexican "cuino", a cross between a goat and a ram which only lived a few days.

## PIGS

1141 — **The Utilisation of the Stomach Contents of Slaughtered Cattle for Feeding Pigs.** — *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 24, p. 10, Paris, June 11, 1918.

Amongst farm animals, the pig is that which best utilises all household or commercial waste of animal or vegetable origin and it does not reject food substitutes which would not easily be accepted by ruminants. Slaughter-house refuse can quite well form part of the pig's daily ration even if it cannot form the whole of it. As an example of such refuse, the blood and stomach contents of slaughtered cattle may be mentioned.

At the moment of slaughtering the stomach of a ruminant contains various sorts of masticated food mixed with mucus and gastric juice. These foods are in a more or less advanced state of digestion, having been acted on by bacteria and the gastric juice for a varying period of time.

In France, by a circular of the Ministry of Food Supplies relating to the previous notice issued by the Director of the National School of Veterinary Medicine at Alfort, the possibility has been shown of feeding pigs on the stomach contents of slaughtered cattle (Circular of July 18, 1917, published in the *Journal officiel de la République française*, July 19, 1917, p. 5587).

On the other hand the German Minister of Agriculture has directed the prefects to order the directors of slaughter-houses in their administrative districts to distribute such refuse free of charge, if that is possible, to those interested that apply for it. Instructions were also added to obtain a better food ration for pigs by using 220 lb. of stomach contents plus 4.4 galls. of blood, 44 lb. of turf treated with molasses, 3.3 lb. of salt and a little chalk. It was admitted that 100 lb. of this mixture had the same food value for the pig as 400 lb. of potatoes.

As it is difficult to obtain turf treated with molasses, it may be replaced by an equal quantity of raw or cooked mangold sliced into fingers.

## FISH CULTURE

1142 — **Researches on the Specific Distinction Between the River Trout, Lake Trout and Sea Trout and the Acclimatisation of Fresh Water Trout to Salt Water** (1). — MURISER, W., in the *Archives des Sciences Physiques et Naturelles*, Year CXXIII, Period 4, Vol. 46, pp. 97-99. Geneva, 1918.

On account of the existence of numerous intermediate forms the list of which is continually increasing, the specific distinction between the lake

(1) See also R., January 1918, No. 70. (Ed.)



trout (*Trutta lacustris* L.) and the brook trout (*T. fario* L.) tends more and more to disappear. For some years the author has made numerous observations on the Lake Lemman trout (*Salmo lemanus* Cuv.), always using individuals hatched from eggs of the same spawning and artificially fertilised, in order to study the mechanism of the gradual formation of the colours. In this way he found that the factors of lighting and oxygenation of the hatcheries, when they act from hatching onwards, can, after 10 months, cause the appearance of 3 sorts of colouring in the trout:— 1) facies of the deep-water, lake trout; 2) facies of the surface lake trout or silver trout; 3) facies of the typical brook trout.

The specific difference between the sea trout (*Trutta trutta* L.) and the brook trout (*T. fario*) is also questionable; CLIGNY'S researches have shown that hereditarily sedentary brook trout can pass to the sea and become sea trout thanks to their preadaptive deep-sea character. The author attempted to ascertain whether this preadaptive character belongs to all the fresh-water trout by carrying out the following experiment:— Lake Lemman trout (this species has inhabited that lake for 10 centuries, according to historical data) were placed in artificial sea water, whose salinity was increased in equal quantity every 24 hours; the subjects were descended from the same father and mother. It was found that a subject can pass suddenly, even every 24 hours, from fresh to salt water of 21 per 1000 strength and even at 35 per 1000 (a salinity equal to that of the Atlantic, according to THOUET) with complete indifference, only showing a slight disturbance due to the different density of the two solutions. The subjects lead an absolutely normal life, and, more voracious in the salt water, develop more rapidly than the control specimens kept in fresh water.

In this experiment, 5 months were sufficient for a lake trout, the descendant of innumerable generations inhabiting fresh water, to become acclimatised to a salinity equal to that of the Atlantic.

1143 - The Death of Carp Suffering from *Cyclochaetosis*, Observed in Italy. — SUPINO F., in the *Reale Istituto Lombardo di Scienze e Lettere, Rendiconti*, Series II Vol. LI, Pt. 6-7, pp. 314-316. Milan, 1918.

The author has noted in the Aquarium at Milan a heavy mortality of mirror carp due to *Cyclochaeta domerguei*. This ciliate had attacked the branchiae, which were very congested, covered with a white film and numerous irregular spots. Up to recently this parasite had only been found in aquariums; Sig. MAZZARELLI (On some diseases of Fish and Crayfish observed in Lombardy, *Atti del III Congresso nazionale della Pesca tenu-tosi in Milano nel 1906*, Milan, 1908) has found it on the gills of shad from Lake Lugano, thus showing it occurs in open water.

*Cyclochaeta* attacks various species of fish; it usually attacks trout and carp, as well as eels, etc.; the author has seen it on some specimens of sun perch and trout-perch in the Milan Aquarium. In scientific literature it is considered as a skin parasite that may invade the gills. In the cases observed by the author on carp, the parasite, very abundant on the gills, to which it was attached by the sucker-shaped lower part of the body, was, on the contrary, completely absent from the skin which was perfectly normal.

As means of control good results have been obtained by repeatedly immersing the carp for 15 to 20 minutes at intervals of 3 to 4 days in a 2 % solution of sodium chloride. The tank containing the fish disinfected with lime and left dry for some time. When the disease is less advanced, it is sufficient to use a very dilute solution (1 per 500 000 or less) of potassium permanganate, which can be run, using the necessary precautions, directly into the tank ; in this way the treatment will be much cheaper.

## AGRICULTURAL MACHINERY AND IMPLEMENTS.

### AGRICULTURAL MACHINERY AND IMPLEMENTS

1144 - **Motoreculture by Electricity.** — GOUY, P., in the *Revue de Viticulture*, Year XXV, Vol. XLVIII, No. 1232, pp. 87-89. Paris, February 7, 1918.

After discussing the part that motoreculture by electricity should play and its advantages, the author states that if electrical motoreculture is to be more generally possible, the large electric works — at present rather scattered and supplying energy chiefly for the urban and industrial centres — should not be depended upon too much, but rather that recourse should be had to other sources of electricity which already exist and could be utilised with advantage.

In the mountains as well as in the hill and plain country there are thousands of little waterworks, mills, etc., which often have more power available in the season than they can utilise. It would be very easy to install turbines or water wheels to drive dynamos, which at small cost would supply a few horse-power to the surrounding estates. This power, divided among the farms, would not only light the houses and stables, but would also run fixed motors for farm work and movable motors for cultivating the soil. In France it is estimated that such small sources give a total of about 1 million H.P., a figure that could be much increased. In fact, many small falls in the country districts of France are not utilised at all. With the help of local initiative, either private, communal or from syndicated groups who would divide the energy among themselves or supply their neighbours, hydro-electric installations could easily be established. Such simple and efficacious combinations would have the advantage of generalising the use of electricity for cultivation and of hastening the utilisation of the water-power as well as the most necessary agricultural progresses.

The author quotes the Senator CHAUVÉAU as to the prices of the H.P.-hour for ploughing : — 1) with a steam windlass locomotive burning 7.7 lb. of coal at 24s. 9d. per ton the cost is 1.92d; 2) with a paraffin engine, 1.44d; 3) with a high-tension electric current at 0.96d. the kilowatt the cost is 0.08d. He also quotes the French Minister of Agriculture, M. F. DAVID, to the effect that the water-power kilowatt used for cultivation costs from 0.38 to 1.42d., while that obtained from coal costs 1.42 to 3.14d. when coal cost 32s. a ton.

**1145 - Public Mechanical Cultivation Trials Organised by the French Ministry of Agriculture and Food Supplies at Noisy-le-Grand, France, in Spring, 1918. —**

I. RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXIX, No. 3, pp. 541-554 + 16 Figs. Paris, May-June, 1918. —

II. *Le Genie Rural*, Year X, Nos. 82 and 83, pp. 8-13 and pp. 10-12 + 12 Figs. Paris, 1918.

I. — The French Ministry of Agriculture and Food Supplies has organised mechanical cultivation trials which took place from April 4 to 10, 1918. There were 55 machines entered by 38 exhibitors but only 36 machines entered by 23 makers or agents actually took part. Amongst these 14 machines entered by 9 exhibitors were of French make, while 22 machines entered by 14 makers or agents were of American make. The 1918 trials were organised with the sole object of putting farmers in touch with the makers or their representatives.

The machines that took part may be classified as follows : —

Cable tractors : — 1) Windlass, 1 French machine ; 2) windlass-tractor, 2 French machines ; 3) Haulage-tractor, 1 French machine.

Tractors : — 8 French and 20 American machines.

Motor-plough : — 1 French machine.

Front-wheel tractor : — 2 American machines.

Rotary cultivator : — 1 French machine.

As most of the machines have already been described or noted, the author only gives details for those machines that have not been previously examined.

Among the French-made machines the author quotes : —

1) The machines of M. MARCEL LANDRIN, of Paris : — 1 apparatus for changing a motor-car frame into a tractor and 1 apparatus changing a motor lorry into a windlass-tractor (1).

2) The windlass-tractors (2) of the "Société française des tracteurs-treuels V. DOISY", of Issy-les-Moulineaux, with a 25-30 H.P. engine.

3) The haulage-tractor of MM. FOLTZ, ELMLINGER and CAILLARD, of Juvisy-sur-Orge (Seine-et-Oise), driven by a 30-40 H.P. engine ; if required this machine can work as a direct tractor.

4) The tractor of M. B. CHAPRON (Fig. 1), of Puteaux (Seine), driven by a 4 cylinder engine, of 60 mm. bore and 120 mm. stroke, giving 10 H. P. at 1200 revolutions per minute ; cooling by thermosiphon, radiator and fan ; 3 speeds of 5806, 9843 and 16404 ft. per hour with direct drive on the low speed used for ploughing.

The driving shaft connects to each wheel through a claw clutch with 4 notches ; there is no differential ; to turn, the wheel on the side of the turning centre is thrown out of gear and braked. In this way it turns with a radius of 5 ft. 5 in., while the wheel-base is 6 ft. The driving wheels are 43 in. in diameter while the tyre is 4 in. wide. A hauling windlass could easily be mounted on the driving wheels, when the machine could be used for digging, pulling-stumps, moving loads on a steep slope, etc.

The wheels, whose position on the axle can be varied as, for example,

(1) See R., February, 1918, No. 208 ; R., August, 1918, No. 892. — (2) See R., August, 1917, No. 753. (Ed.)

in the case of hoeing, are 24 in. in diameter. The front-carriage does not press heavily on the soil but when the traction passes a certain limit, it must be loaded with an extra 360-370 lb.

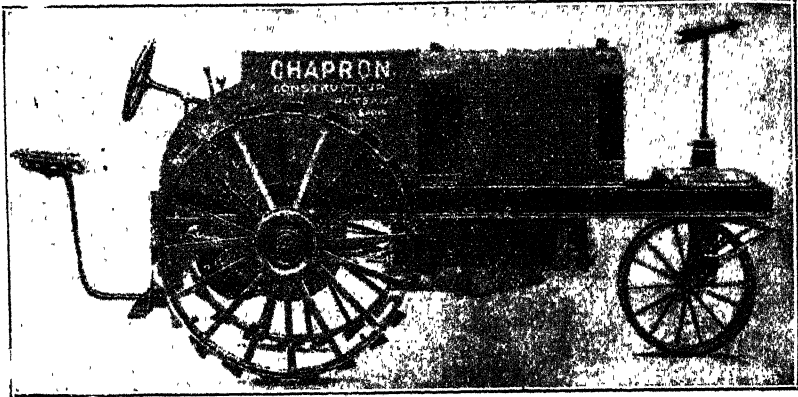


Fig. 1. — CHAPRON tractor.

The engine is mounted on springs so that it can be used for road transport.



Fig. 2 — DIMPRIE tractor.

The total length of the tractor is 8 ft. 10 in. and its greatest width is from 36 to 38 in. ; it weighs 2310 lb. and costs about £ 392. This tractor

is easy to drive, and it may be used for cultivating in vineyards; it has been tested for this purpose at Montpellier, in vineyards near the National School of Agriculture.

5) Two English SAUNDERSON (1) tractors entered by the Paris General Omnibus Company. They are of 10 and 20 HP. and the Company proposes to make them in France.

6) The tractor made by M. H. DIMPRE, 35, Rue du Banquier, Paris, with a 40 H.P. engine. This tractor has the appearance of a motor lorry (Fig. 2 p. 1218.).

7) the "Aurore" tractor built by M. M. FOURNIER, of Levallois-Perret (Seine), whose engine drives the 4 equal-sized wheels. By removing

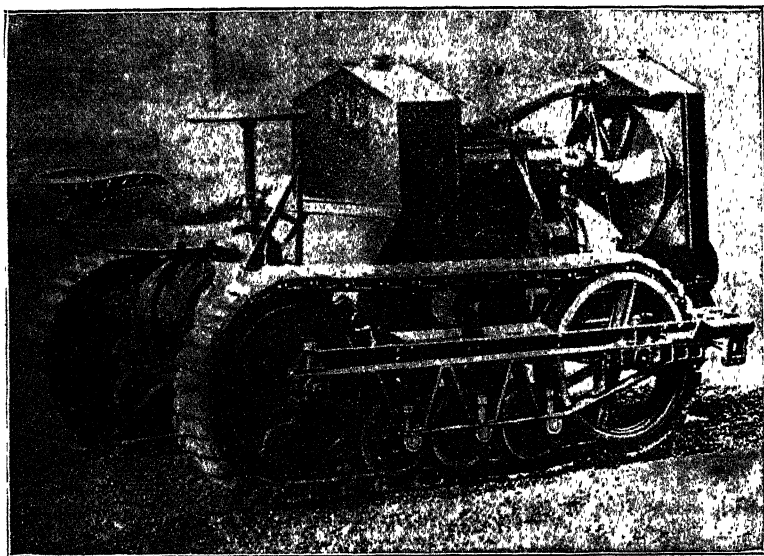


Fig. 3. — CLEVELAND tractor.

the horizontal chain drive to the front axle, the machine becomes a tractor with 2 driving wheels.

8) The "Motoculteur" of the "SOCIÉTÉ LA MOTOCULTURE FRANÇAISE" (2) which either works with rotatory implements or as a direct tractor.

9) the motor plough of MM. TOURAND-LATIL, of Suresnes (Seine) (3).

Among the American-made machines the author quotes: —

1) The "Cleveland" tractor (CLEVELAND TRACTOR C<sup>y</sup>, Cleveland, Ohio) presented by the ALLIED MACHINERY CO. of France, 19, rue de

(1) See *R.*, June, 1918, No. 678. (*Ed.*)

(2) See *R.*, January, 1918, No. 84. (*Ed.*)

(3) See *R.*, August 1917, No. 753. (*Ed.*)

Rocroy, Paris. This chain track tractor (Fig. 3) designed by Mr. R. H. White, is driven by a 20 H.P. engine; its dimensions are: — length 8 ft., width 4 ft. 1 in., height 5 ft. 3 in.; it weighs 3 344 lb. Each chain track is 7 in. wide and a length of 4 ft. 1 in. touches the ground; the distance between the axes of the chain wheels is 38 in. The frame, 12 in. above the ground, is mounted on springs. It can move up to 3 miles an hour and its smallest turning radius is under 6 ft. In the latest models the chain wheels and rollers are cased in.

2) The GRAY tractor (1), presented by the AMERICAN TRACTOR CO.,

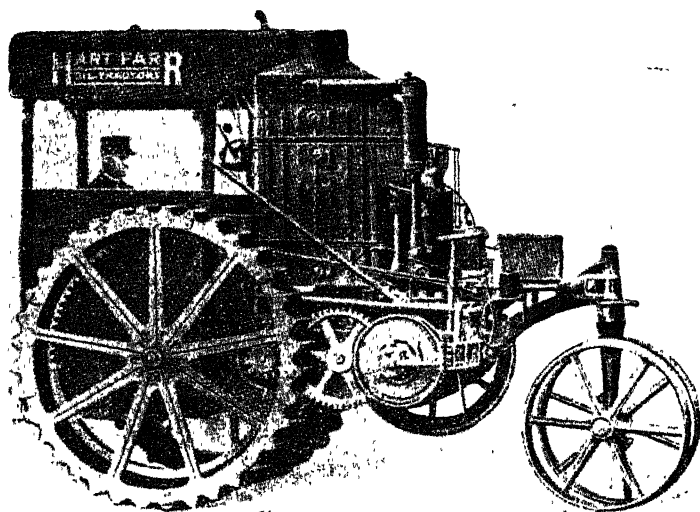


Fig. 4. — HART PARR tractor.

11, Avenue du Bel-Air, Paris. This 30 H.P. tractor is sold at approximately £ 678.

The *Génie Rural* (No. 83) gives the following information about this tractor: — The GRAY tractor belongs to the type of tractor with a single, very broad driving wheel. That of this tractor is 51 in. wide with a diameter of about 59 in. The fore-carriage, mounted on a pivot-bearing, has wheels with a diameter of 37 in. and a width of 9 in. The tractor is 14 ft. long, 6 ft. 3 in. broad and 5 ft. high; it weighs 5 040 lb. The 4 cylinder WAUKESHA motor of 113 mm. bore and 170 mm. stroke runs at 850 revolutions. The BENNETT carburettor and the regulator are enclosed. The magneto and gas controls are fixed on the steering wheel. The driving wheel is connected by two symmetrical chains enclosed in oil baths.

(1) See *R.*, January, 1918, No. 81. (*Ed.*).

There are two speeds forward (2 and 3 miles per hour) and a reverse (2 miles per hour).

3) The "Hart Parr" tractor (Fig. 4, p. 1220), entered by the BUTTEROSI SYNDICATE, 148, avenue Malakoff, Paris, is driven by a single-cylinder vertical engine of the pilon type, of 250 mm. bore, 250 mm. stroke, and developing 35 H.P. at 500 revolutions per minute; cooling is by oil circulation. The front wheels, very close together, are 3 ft. 3 in. in diameter; the rear wheels, 6 ft. in diameter and 14 in. wide, are of cast steel with a grooved tyre; the arched grips are bolted on the grooves and project beyond the edge.



Fig. 5. — GALLOWAY tractor.

The Hart Parr tractor has two speeds, 9 515 and 12 452 ft. per hour, and its total weight is 11 440 lb.

According to *Le Génie Rural*, the Hart Parr tractor is composed of 300 different pieces, or 500 to 600 pieces less than all the other similar machines in existence. This great simplicity lessens wear and the risk of disastrous breakages during the working season.

4) The 2 CASE (1) tractors, entered by the CASE COMPANY, 251, rue du Faubourg St. Martin, Paris: one 18 H.P. tractor and one of 25 H.P.

5) The 20 H. P. MOGUL (2) tractors and the 20 H. P. TITAN (3), entered by the COMPAGNIE INTERNATIONALE DES MACHINES AGRICOLES, 155, rue Michel Bizot, Paris.

6) The 20 H. P. EMERSON tractor (4) entered by the CULTURE MÉCANIQUE Co., 175, rue de Flandre, Paris.

(1) See R., June 1914, No. 557; R., March and April, Nos. 274 and 753. — R., January 1918, No. 81. (Ed.). — (2) See R., June, 1916, No. 670. — R., 1917, Nos. 274, 753 and 1051. — (3) See R., 1917, Nos. 274 and 1051. — (4) See R., June, 1916, No. 670 — R., 1917, Nos. 274, 753 and 1051. (Ed.).

7) The 16 H. P. HAPPY-FARMER tractor (1) (sale price £420) and the 24 H. P. PARRETT tractor (1) (sale price £ 800), both entered by Messrs GASTON, WILLIAMS & WIGMORE, 1 rue Taitbout, Paris.

8) the GALLOWAY tractor (Fig. 5), entered by the ETABLISSEMENTS DE LACOUR ET FABRE, 4, avenue de Villiers, Paris. This tractor is driven by a 4 cylinder, vertical WAUKESHA engine, of 89 mm. bore and 133 mm. stroke developing 20 H. P. at 1 100 revolutions per minute The carburetter

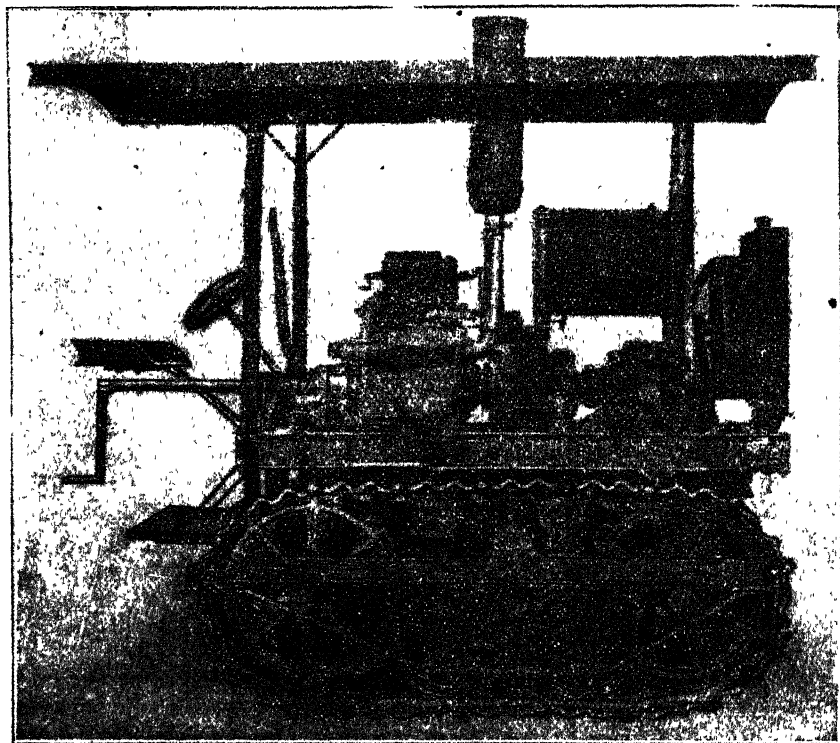


Fig. 6. — NEVERSLIP tractor.

can be used for burning petrol or paraffin. The first model introduced into France is interesting for several details : — the engine is cast solid with the working parts and enclosed in a case ; the driving wheels are chain-driven and are 58 in. in diameter with tyres 14 in. wide. The central-sprung front axle, can deviate greatly compared with the back axle ; the front wheels are 36 in. in diameter with 5 in. tyres. The machine is 12 ft. 4 in. long,

(1) See R., January 1918, No. 81. (Ed.).



77 in. wide and 73 in. high; its total weight is 4 983 lb. of which 1 390 lb. are supported by the front axle and 3 593 on the back axle.

9) the **MOLINE** tractor (1) of the **MOLINE PLOW CO.**, 150 bis, quai Valmy, Paris; 2 machines were entered to show the improvements effected.

10) The **NEVERSLIP** tractor (Fig. 6), entered by Mr. A. W. **PIDWELL**, 19, boulevard Malesherbes, Paris. This tractor runs on the **NEVERSLIP** chain track. The 4 cylinder vertical engine (102 mm. bore and 152 mm. stroke) develops 25 H.P. at 850 revolutions per minute. The 2 forward speeds give 0.87 and 2.73 miles per hour and the reverse 1.49 miles per hour.

Each chain tread is 12 in wide and a length of 5 ft. is in contact with the soil. The machine is 9 ft. 6 in. long, 5 ft. 4 in. wide and 6 ft. without the shelter-roof and 9 ft. 5 in. with it.

11) 2 **AVERY** tractors (2), entered by Mr. T. **PILTER**, 24, rue Alibert, Paris; the 16 H. P. model costs £436 and the 25 H. P. model £660.

12) The 25 H. P. **BULL** tractor (3) entered by **SCHWEITZER & Co.**, 86 rue de Flaudre, Paris,

13) Two **ROCK ISLAND** tractors (4) of 16 H. P. (sale price £572) and 20 H.P. (cost, £740) and one 25 H.P. **LITTLE GIANT** tractor (5) (cost £900), entered by the **SOCIÉTÉ DES MACHINES AGRICOLES R. I. P.**, 60, avenue de la République, Paris.

14) The **MACCORMICK** tractor (20 H. P. Titan tractor) entered by Messrs **R. WALLUT & Co.**, 168, boulevard de la Villette, Paris.

II. — *Le Génie Rural* describes some of the most interesting machines entered for the Noisy-le-Grand trials and gives numerous figures.

**1146 - The Production of Agricultural Material and the Maximum Prices for Agricultural Machinery and Implements, in France.** — I. **MARIS-BESNARD**, in the *Bulletin mensuel de la Chambre Syndicale des Constructeurs de Machines Agricoles de France*, No. 4, pp. 169-175 + 1 Table. Paris, June, 1918. — II. *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 29, pp. 9-10 + 3 Tables. Paris, July 16, 1918.

The results of an inquiry made by M. **MARIS-BESNARD**, President of the "Chambre Syndicale des Constructeurs de Machines Agricoles de France".

The author thinks that, in order to estimate the French output of agricultural material, the number of workmen employed in French works must be used as a basis because, according to the evidence available, it can be shown that the market value of the products of a manufactory divided by the number of workmen gives a market value per workman that agrees very closely for similar industries with equal equipment.

For a large number of manufacturies this figure is 6666 francs (about £ 264.14s). One manufacturer who is best equipped and works in series, can arrive at 20 000 francs per workman. With smaller firms a figure slightly less than 6000 fr. is arrived at.

The "Chambre Syndicale des Constructeurs de Machines Agricoles de France" unites 410 firms making machinery, tractors, agricultural implements, appliances for dairying and agricultural industries. **DEBRAY'S**

(1) See R., 1917, Nos. 941 and 1051. — (2) See R., Aug., 1917, No. 753 — (3) See R., Sept., 1915, No. 953 and R., 1917, Nos. 274 and 1051. — (4) and (5) See R., 1917, No. 1051. (Ed.)

yearbook of Agricultural Construction mentions 1500 small firms making ploughing implements with 2 or 3 workmen, and which altogether represent about 1500 workmen.

Besides this there are thousands of workmen, farriers, smiths and ploughwrights that buy parts of the machines and assemble them. Their production can be estimated from the quantity of material supplied to them.

The author summarises in table-form the chief elements of French pre-war construction, using as basis documents and information supplied by the more important makers. No mention is made of the production of machines for mechanical cultivation — tractors, windlasses, etc. — which, in an embryonic stage before the war, is now undertaken by 22 firms, forming part of the Syndicate, and able to produce thousands of machines annually.

This table shows that the number of Brabant ploughs made in France in 1913 was 40 000 (64 syndicated firms) while that of various ploughs was 200 000 (2 000 small makers); the number of cultivators, harrows, rakes, was 150 000, and that of rollers was 50 000; 6 000 machine drills and manure distributors (10 firms) and 12 000 drills (11 firms) of various types were made; 5 firms made 10 000 mowers, and 7 made 3 000 harvesters and binders; 3 000 threshing sets were made by 48 firms; the number of agricultural motors made rose to 2 800 for 21 firms and 3 200 for the non-syndicated firms; 25 firms made 40 000 pumps; 27 makers made fixed farm machinery (root-choppers, mills, sifters, etc.) to the number of 230 000; the number of presses and apple-pounders, etc., rose to 180 000; 30 000 dairy appliances were made in 1913; about 100 firms made various types of implements, etc.

The production could be increased by 15 to 20 %, on taking into account about a thousand small, non-syndicated firms employing 2 or 3 workmen. The table also shows the tonnage produced (129 350 metric tons) and its market value (132 180 000 fr.).

II. — The French Minister of Agriculture has given his approval to the list of maximum prices for agricultural implements and machinery, proposed by the presidents of the "Chambre syndicale des constructeurs de machines agricoles", the "Chambre syndicale du commerce des machines agricoles", the "Consortium des fabricants de machines d'agriculture" and the "Consortium des industriels de la ferrure".

The maximum prices thus fixed for French and foreign-made machines respectively are : —

750 and 775 fr. for 1-horse mowers; 850 and 875 fr. for 2-horse mowers; 1150 and 1175 fr. for reapers cutting 49 in.; 1175 and 1200 fr. for reapers cutting 53 in.; 1215 and 1240 fr. for reapers cutting 59 in.; 2275 and 2300 fr. for binders cutting 59 in.; 2400 fr. for foreign-made binders cutting 83 in. (on account of increased freights, the delivery price of foreign-made binders includes an increase of 400 fr., that of foreign reapers 200 fr., and that of foreign mowers 150 fr.); 530 fr., 545 fr., and 565 fr. for French horse-rakes with 24, 26 and 28 teeth; 485 and 510 fr. for foreign horse-rakes of light type with 26 to 32 tines; 975 and 1100 fr. for tedders 96 in. wide; 950 and 975

fr. for tedders 71 to 96 in. wide ; 675 and 760 fr. for fork tedders (6 forks with 4 tines). The maximum price for sisal and manilla binder twine is fixed at 5.65 fr. the kg.

As regards all-metal ploughs (save those specially made for tractors), the maximum price has been fixed at 4 fr. the kg. for those weighing up to 110 kg.; at 3.75 fr. the kg. for those from 110 to 150 kg.; and at 3.50 fr. the kg. for those weighing more than 150 kg. For weeders, scarifiers, with steel frames and rigid or spring tines, the maximum price is 2.65 fr. the kg.; for metal harrows, 2.50 fr. the kg.; for 1-row hoes, 4 fr. the kg.; for hoes for more than one row, 3 fr. the kg.; for steel-sheet rollers, 1.40 fr. the kg. and for those in cast iron, 1.30 fr. the kg.

**1147 - Exports of Implements, Twine, Tractors and Gas Engines from the U. S. A. for the Period 1915 to 1917.** — *Farm Implement News*, Vol. XXXIX, No. 14, p. 21 + 1 Table. Chicago, April 4, 1918.

The exports of implements, tractors and gas engines from the U. S. to other parts of the world from 1915 to 1917 inclusive is shown in the following Table:—

Articles exported	1915		1916		1917	
	Quantity	Value	Quantity	Value	Quantity	Value
		\$				
Hay rakes and tedders	—	212 934	—	301 175	—	777 583
Mowers and reapers, .	—	4 367 181	—	7 347 406	—	12 740 298
Planters and seeders .	—	274 391	—	340 437	—	431 358
Ploughs and cultivators	—	3 371 915	—	5 202 047	—	7 592 145
Threshers . . . . .	—	1 563 245	—	1 933 974	—	2 749 785
Parts, etc. . . . .	—	3 793 183	—	6 104 755	—	9 222 570
<i>Total . . .</i>	—	<b>13 582 849</b>	—	<b>21 229 774</b>	—	<b>33 513 739</b>
Binder twine . . . lb.	108 241 737	8 601 520	156 184 298	15 317 309	129 705 369	20 163 041
Stationary gas engines . . . . . No.	2 415	457 409	3 446	406 297	6 083	840 175
Stationary petrol engines . . . . .	20 039	1 549 242	33 231	2 886 275	27 550	3 240 196
Traction and caterpillars (petrol) .	660	1 303 209	3 939	6 208 868	14 233	16 155 184
Kerosene engines .	—	—	—	—	6 539	2 009 915

**1148 - The Price of Binder Twine in the U. S. A., in 1918.** — *Weekly News Letter*, U. S. Dept. of Agriculture, Vol. V, No. 42, p. 4. Washington, May 22, 1918.

The prewar price for sisal averaged about 7 cents per lb. It was 7 ½ cents landed at ports of entry in June, 1916. In July of the same year, it was increased to 10 cents at which price it remained till December, 1916, when it rose to 16 ½ cents in March, 1917. In August 1917, it reached 19 cents at Gulf ports and 19 ¼ cents delivered at New York.

The cost of binder twine from sisal and other sources has been officially fixed for 1918 at 23 cents f. o. b. factory for 500 ft. twine, other grades being in proportion. The wholesale price is slightly higher to allow the dealers a fair profit. An ample supply of binder twine was assured for the harvest.

1149 - **The Jean Bache Vineyard Tractor.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXIX, No. 3, pp. 565-566 + 1 Fig. Paris, May-June, 1918.

So that the tractor can pass between the lines of vines planted from 59 to 79 in. apart after the end of May, when the branches tend to cross, M. BACHE suggests the use of the machine A (see Figure), mounted on 3 wheels, of which 2, the front wheel *a* and the driving wheel *m*, could pass in the middle of the space *y' y'* which would be turned over by the plough *C*, whilst the third wheel *r*, on the left at the back, would pass in the space *yy'* and would only serve to maintain the balance of the machine. The third wheel might be loose on its axle so that its tyre (like that of the wheel *m*) would

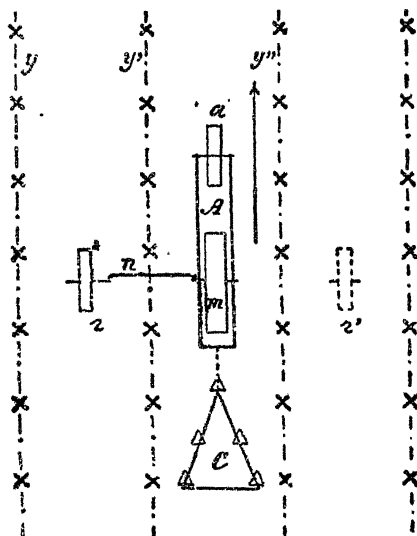


Diagram of M. JEAN BACHE's vineyard tractor.

always run exactly in the centre of the space *yy'* between the rows of vines.

The greater part of the weight of the engine would be carried by the broad-tyred wheel *m*; the axle joining the wheels *r* and *m* would be elbowed, forming a sort of bridge *n* at least 59 in. high that could pass over the branches of the row of vines *y'* without harming them. Under these conditions the machine would have to turn to the left, as is always done with animals in the vineyards of southern France. As the space between the rows should be cultivated over its whole width in one turn, to facilitate turning 2, 3 or even 4 can be passed over on the headland, being cultivated afterwards.

The first model of the DESSAULES tractor (1) tried by the author in

(1). See R., January, 1918, No. 81 and R., March, 1918, No. 331. (Ed.)

1917 at Noisy-le-Grand, France, is similar in principle, save, that, in the rear, there is a second balance wheel  $r'$  symmetrical to the wheel  $r$  relatively to the driving wheel  $m$ , so as to provide for the transverse stability of the tractor.

**1150 - Rotary Harrow Attachment for Sulky and Multiple Gang Ploughs.** — POTTER, P. B., in the *Scientific American*, No. 22, p. 502 + 1 Fig. New York, June 1, 1918.

The rotary harrow described consists of a single gang of closely spaced spading discs. Each disc is made up of a number of sharp, steel blades, which are narrow and have a curved and twisted shape.

As the discs roll along, the blades stab and slice the furrow to pieces, and as there is a considerable number of blades, the surface is left with a fine even mulch. There is a lever for regulating the depth and a spring for adding pressure to the blades. As the discs have rather a revolving action than a dragging one, there is only an increase of 7 to 10 % in the draught on the plough. The attachment is made to clamp tightly to the plough frame and is readily adjustable in any direction ; it can be purchased for the single-bottom sulky or the multiple-bottom engine gang.

As the soil is freshly ploughed, it is more easily pulverised, provided the ploughing has been done under the right conditions.

**1151 - The Production of Groats and Oatmeal.** — *The Implement and Machinery Review*, Vol. XLIV, No. 518, p. 182 + 2 Figs. London, June 1, 1918.

Description of an oat milling plant, with figures showing the arrangement of the plant in a simple building, according to the plans of A. R. TATTERSALL & Co., milling engineers, 75D, Mark Lane, London.

Before milling the oats must be thoroughly dried, either in an ordinary kiln heated by coke, or by special oat-drying apparatus (which is preferred in some cases).

The dry oats are elevated automatically from the kiln floor and deposited in a bin ready for cleaning. From this bin the oats fall by gravitation into a special separator and cleaner, which delivers the grains sufficiently cleaned for treatment in the mills. From the cleaner, the oats are elevated and drop into a bin from which they fall to the shelling mill. This mill is fitted with stones of large diameter, fixed horizontally to a vertical shaft, which loosen the outer cuticle or shell of the grain ; the material is removed automatically to a reciprocating sieve, which eliminates any flour or meal made in the shelling process, and the overtails of this sieve are passed through a blower or aspirator for removing the loose shells. The groats are elevated to another bin, also placed over the shelling bin, to repass the stones, when a second separation is made on the sieve and blower. The shelled oats or "groats" next fall into a hopper fixed over the grinding mill, of the "India" pattern, fitted with stones of a special texture suitable for reducing the groats into fine meal as may be required. Following this the flour passes into a double vibrating sifter in conjunction with another blower for removing the fine particles of husk which may be still left in the meal.

This is a type of plant much favoured in Ireland, which country is now a rapidly increasing producer of oats and oatmeal.

*Oat-milling plant of TATTERSALL & Co.*

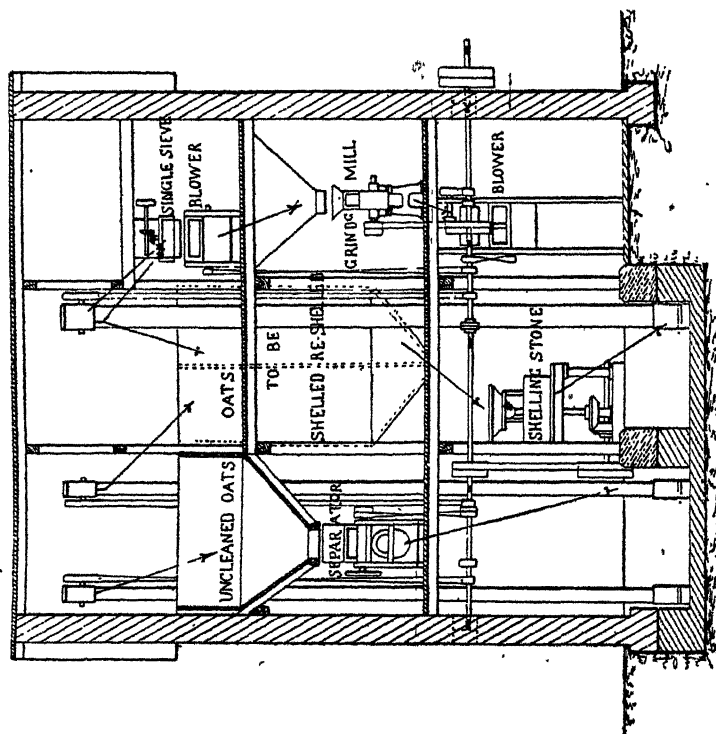


Fig. 1. — Side view.

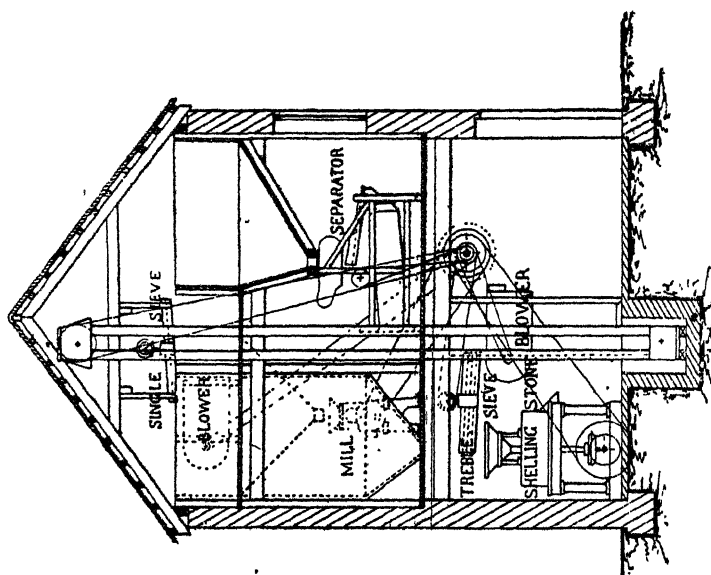


Fig. 2. — End view.

1152 - **The Scott Process and Plant for Drying Potatoes.** — *The Implement and Machinery Review*, Vol. XLIV, No. 518, pp. 184-186 + 4 Figs. London, June 1, 1918.

In the SCOTT process the potatoes are delivered into a washer, which consists of an inclined trough fitted with a revolving spiral. The spiral is

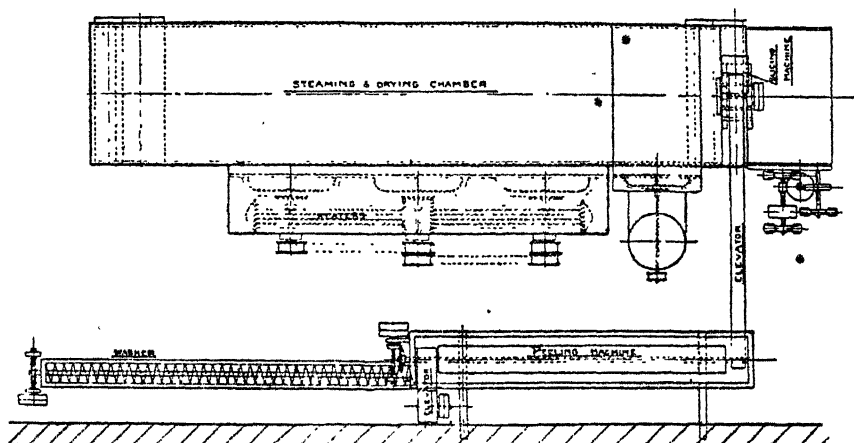


Fig. 1. — Scott drying plant: Plan.

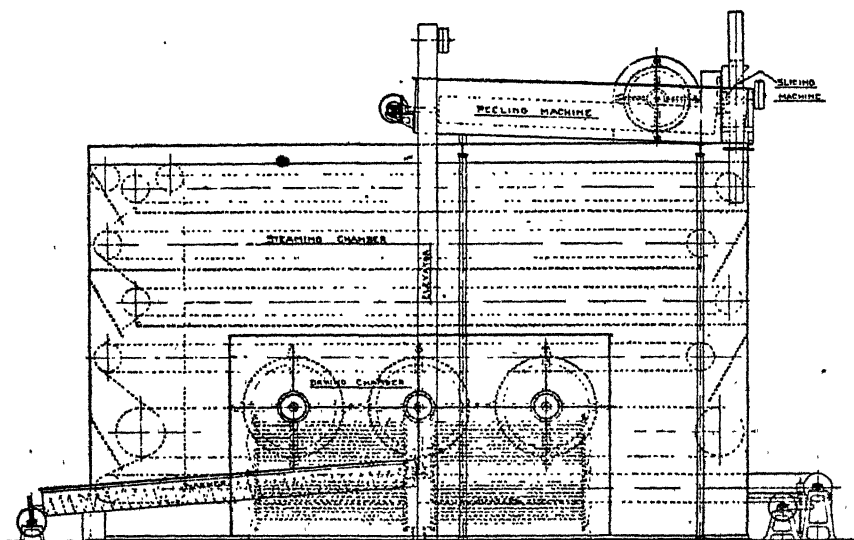


Fig. 2. — Scott drying plant: Elevation.

driven slowly and forces the potatoes along into an elevator boot. At this point is fitted a device for separating the stones, adjusted so as to float the

tubers but not the stones. A stream of water runs continuously in a contrary direction to the potatoes and so washes off all dirt.

As is shown in the appended figures, the potatoes are now elevated into a *peeling machine*, which consists of a rotating cylinder, the interior of which has an abrasive surface which rasps the skin from the tubers, the peelings passing to the bottom of the containing tank. The rotating cylinder is slightly inclined to induce the potatoes to travel forward. The peeling operation is also carried out under water; the resulting sludge, when filtered and dried makes an excellent cattle and poultry food

After peeling the potatoes are conveyed to a *slicing machine*, the buckets of this second elevator being perforated to complete the draining of the

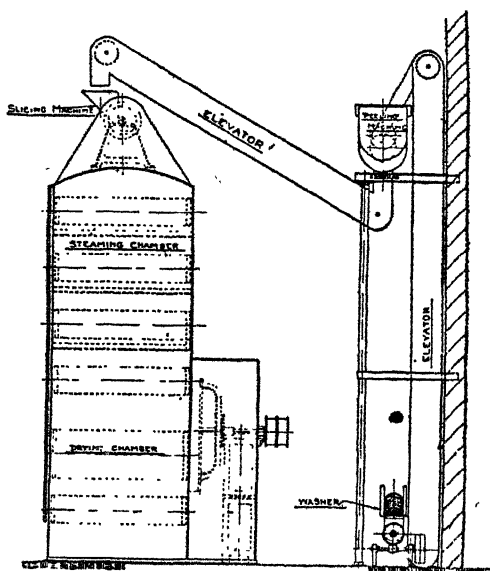


Fig. 1. — SCOTT drying plant: end view.

potatoes. The slicing machine consists of a rapidly revolving disc fitted with cutting knives. The potatoes are fed up to these knives by means of a suitable hopper, and from this point they pass in fine slices into a *drying machine* over a spreading device which distributes them evenly.

The drying machine is in 2 portions. In the upper part or steaming chamber, the potatoes are constantly in contact with steam, which is led into this portion by suitable pipes. The lower and larger portion is the drier



proper. This consists of a closed chamber, containing a number of endless moving bands which carry the charge through the chamber. The slices are spread on the top band and travel along to the far end of the machine, when they drop on to the next lower band, and are carried to the feeding end of the chamber. This forward and backward process is repeated until the lowest band carries them right out of the chamber, dry, and deposits them at some point ready for grinding.

The actual drying is carried out by hot air. The air is heated by drawing it over steam-heated pipes by means of large fans which force it to perform a continuous circuit through the heater, into intimate contact with the steamed potato slices, then back through the heater, and so on.

An extraction fan constantly withdraws a small portion only of the most saturated air, and this is replaced by fresh air at a convenient spot near the heating pipes. In this way great economy is effected in steam consumption, as partly used air is directed into the drying chamber again and again, so obviating the necessity for heating up a complete supply at each journey through the drying chamber and thus avoiding the loss of heat in the exhaust air.

Throughout the whole of the operations the material is never handled, and labour is thus reduced to the bare handling of the potatoes on reception. By the provision of suitable silos in large plants even this operation can be made of insignificant importance.

Where steam is not available for heating, the makers provide a direct-fired air heater which can burn any kind of fuel.

Messrs. SCOTT & SON Ltd., 72 Oxford St., London, make all the plant necessary for drying potatoes preliminary to milling, but do not manufacture the milling plant. However, any machine suitable for fine grinding, fitted with fine screens, would meet requirements, such as a CARTER disintegrator, fitted with a sifting reel and bagging attachment.

The SCOTT drier can also be used for other vegetables as well as fruits. The machine costs more than ordinary driers, but it more than repays its extra cost in the economy of labour and fuel.

**1153 - Peanut Decorticators.** — See No. 1160 of this Review.

**1154 - Machines for the Recovery of Grape Stones for the Production of Oil.** — VENTRE, J., in *Le Progrès Agricole et Viticole*, Year XXXV, Vol. LXX, No. 29, pp. 54-61 + 2 Figs. Montpellier, July 21, 1918.

For the satisfactory recovery of the stones from grape residue, the author shows that a sifter is necessary for large works dealing with 22 000 to 44 000 lb. of residue a day, while a cylindrical sorter suffices for smaller establishments.

The sifter described by the author consists of a wooden frame supporting a sheet of galvanised iron wire gauze with an 8 mm. mesh sloping at 15 to 18°. The frame is attached to the bed by carriage-springs 6 mm. thick and strengthened at their lower part to avoid breakage. The frame is moved to and fro by a cranked shaft at the rate of about 250 oscillations per minute. The sifter is about 9 ft. long of which 6 ft. 6 in. is used, the 2 ends being

strengthened with iron so that the residue will not break the gauze in falling on it ; it is 31 in. wide. The residue arriving at the upper part of the frame moves along as the result of its own weight and the oscillating motion. The sifting forces the residue to turn, thus shaking and scraping it on the gauze. The stones fall through with a little pulp that can easily be separated by cleaning in the winnowing-machine. Some  $\frac{3}{4}$  to 1 H.P. are required to drive the machine, which can treat from 22 000 to 44 000 lb. of residue per day, separating from 6 600 to 8 800 lb. of stones. The sifter deals equally well with wet residues from diffusion vats or distillation apparatus.

The cylindrical sorter consists of a cylinder covered with galvanised-iron wire gauze with an 8 mm mesh ; its diameter is 22 in. and its length 6 ft. 6 in. To strengthen it and prevent the gauze from bulging the cylinder is enclosed with 5 iron hoops (1 at each end and the others every 20 inches) fasted to the central axle with iron ties and to one another with hoop-iron. The cylinder is supported by 2 iron-shod poles carrying a bearing in which runs the central axle. The cylinder is inclined at about 12.5 % to the horizontal to speed-up the work ; it runs at 35 to 40 revolutions a minute. Two men are required, one to turn the cylinder, the other to feed in the residue. Some 880 lb. of stones may be obtained in a day, but as the machine is slow and the work is not so well done as in the sifter, it should only be used with dried residue. The two machines are not complicated, and they are easy to make. With them both commercial men and vine growers can rapidly recover the stones without waiting for fermentation to start in the residue, coagulating the pectic matter, which would have the double disadvantage of hastening the resinification of the fatty acids of the oil and also of favouring the retention of a large quantity of pips in the pulp.

The stoned residues can be at once ensilaged for feeding live stock, especially sheep.

#### 1155 - Review of Patents.

**TILLAGE MACHINES AND IMPLEMENTS.** — *Canada*: 182788 Wheel plough ; 182804 Grubbing implement.

*France*: 486735 The use of the BAUDRY motor-binder (1) as a motor plough, etc. ; additions Nos. 20598 and 20599 ; 487693 Plough consisting of 2 motor-driven, identical and juxtaposed screws.

*United Kingdom*: 116366 Harrow ; 116795 Device for automatically raising the frame of a motorplough or cultivator.

*United States*: 1267502-1268893 Ploughs ; 1268060 Stalk cutter ; 1268150-1268861 Harrows ; 1268319 Combined harrow and roller ; 1268823 Plough cleaning attachment ; 1269028 Motor driven agricultural machine ; 1269138 Wheelplough ; 1269166 Wheeled disc plough ; 1269484 Earth scraper ; 1270087 Land roller ; 1270180 Agricultural implement ; 1270299 Disc harrow ; 1270317 Rotary harrow ; 1270525 Traction plough ; 1270627 Motorplough.

(1) See R. July, 1918, No. 309, patent No. 486735. (Ed.)

**DRAINAGE AND IRRIGATION.** — *Sweden*: 42852 Watering device for field or garden; 42955 Ditching machine.

*Switzerland*: 78751. Ditching machine.

*United States*: 1268148 Ditching attachment for turning plough; 1270597 Corner finisher for irrigation.

**MANURES AND MANURE DISTRIBUTORS.** — *Sweden*: 42643 Feeding device for fertiliser distributor; 42675-42887 Manure spreaders; 42922 Liquid-manure spreader.

*United Kingdom*: 116758 Manures obtained by treating with yeast peat and farm or agricultural refuses and added with phosphoric and potassic materials.

*United States*: 1267563 Broadcast spreader; 1269189 Method of recovering fertilising material from tannery waste liquids; 1270070 Fertiliser distributor; 1270071 Feeding mechanism for fertiliser distributor.

**DRILLS AND SEEDING MACHINES.** — *Sweden*: 42781 Device for drills; 42853 Potato planter.

*United States*: 1267397 Potato seed cutting machine; 1267583 Peanut planter; 1267713 Check row transplanter; 1267762 Landmarker for planters; 1268291 Check row planter attachment; 1269451 Maize planter; 1269591-1270577 Planters; 1269877 Hand seed planter; 1270109 Attachment for grain drills.

**VARIOUS CULTURAL OPERATIONS.** — *Netherlands*: 2545 Temporary, portable, glass-roofed shelter for young plants.

*Sweden*: 42983 Device for horse-hoe; 42985 Hoe with hollow handle provided with a device for sowing forage seeds; 42986 Hand hoe.

*Switzerland*: 78750 Hand-hoe.

*United Kingdom*: 116175 Hand hoe, rake, marker and clod chopper combined; 116525 Combined rake and hoe.

*United States*: 1267425-1268117 Shield attachment for maize planters; 1267518 Cultivator shovel; 1268042 Cotton chopper; 1268687 Potato cultivator; 1269129 Weeding machine.

**CONTROL OF DISEASES AND PESTS OF PLANTS!** — *Canada*: 183160 Animal trap.

*New Zealand*: 38637 Weed eradicator and digger.

*Sweden*: 42561. Apparatus for destroying injurious insects.

*United Kingdom*: 115755 Animal trap; 116762 Device for raising and supporting vegetation whilst sprayed underneath with a sprayer.

*United States*: 1267391-1268166-1269596 Animal traps; 1268127 Insect catcher; 1268660-1269334 Boll weevil destroyers; 1268992 Quackgrass digger.

**REAPERS, MOWERS AND OTHER HARVESTING MACHINES.** — *Canada*: 182878 Binder mechanism.

*New Zealand*: 39806 Fruit picker.

*Sweden*: 42528 Divider for mower; 42723 Fruit picker; 42923 Grain saving attachment for harvester.

*Switzerland*: 78753 Binding apparatus.

*United Kingdom*: 116191 Rubber tapping knife; 116300 Motor driven sugar cane harvesting machine; 116522 Flax pulling machine.

*United States* : 1267559 Kafir corn header ; 1267614-1268902-1269550-1270202 Peanut harvesters ; 1267938 Shock binder ; 1268169-1269516 Shocking machines ; 1268302 Attachment for harvester-header ; 1268345-1268384 Maize huskers ; 1268698 Adjusting device for harvesting machine ; 1268882 Attachment for sweep rake ; 1269161 Elevator support for harvester ; 1269393 Sweep rake ; 1269522 Combined harvester ; 1269742 Seed harvesting machine ; 1269781 Binder attachment ; 1270016 Butt adjuster mechanism for grain binder ; 1270487 Gearing for mowing machine ; 1270488-1270489-1270490-1270491 Mowers.

**MACHINES FOR LIFTING ROOT CROPS.** — *Denmark* : 23081-23098 Turnip harvesters.

*Sweden* : 42500 Continuous horizontal conveyer for attachment to beet diggers ; 42704 Beet topping machine ; 42822 Beet digging and topping machine.

*United Kingdom* : 116120 Potato digger and harvester.

*United States* : 1267692 Potato separator ; 1268085-1269789 Beet harvesters ; 1268388-1269371 Beet toppers ; 1270503 Beet topping device for beet harvesting machine.

**THRESHING AND WINNOWER MACHINES.** — *Canada* : 182968 Threshing machine ; 183056 Vacuum grain loader and cleaner.

*United Kingdom* : 115951 Apparatus for the separation and dressing of seeds and grain.

*United States* : 1268857 Conveyer attachment for threshing machine ; 1269033 Feeder for threshing machine ; 1269109 Threshing machine ; 1269211 Pea viner.

**MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC.** — *Canada* : 183240. Stacker feed mechanism.

*New Zealand* : 38870 Flax stripping machine.

*United Kingdom* : 116178 Baling press ; 116238 Hay collecting and cocking machine which may be provided with threshing drum for separating the seeds from the hay ; 116333 Scutching apparatus ; 116378-116789 Hay cocking machines.

*United States* : 1268122 Hay and bundle loader ; 1269358 Grain transferring device ; 1269435 Automobile truck ; 1270123 Hay loader ; 1270145 Baling press.

**FORESTRY.** — *Canada* : 182804 Grubbing implement.

*France* : 487366 Machine for felling and cutting trees.

*Sweden* : 42635 Small brush bunding machine.

*United Kingdom* : 116015 Portable saw for felling and cutting trees ; 116783 Sawing machine for cutting felled timber.

*United States* : 1270010 Method of treating decayed spots and cavities in wood.

**TRACTION AND STEERING OF AGRICULTURAL MACHINERY.** — *Canada* : 182695 Coupling for hay racks.

*France* : 486496 CHAPRON agricultural tractor (1) improvement, addition No. 20578 ; 487763 Agricultural tractor.

(1) See R. June, 1918, n° 682, p. 747, patent 486455 (for this number read No. 486496).  
(Ed.)

*New Zealand*: 39892 Windmill.

*United Kingdom*: 116112 Transmission gearing for motorploughs and motorvehicles; 116141-116142-116143-116144-116145-116164 Endless track vehicles; 116180 Tractor.

*United States*: 1267503-1267525-1267825-1267986-1268034-1268324-1270480-1270531 Tractors; 1267768 Traction engine; 1268116 Tractor attachment for motor truck; 1268417 Automobile traction wheel attachment; 1268493-1270252 Tractor wheels; 1268517 Traction tread device for tractor wheels; 1269293 Device for attaching ploughs to vehicles; 1269609 Steering device for traction engine; 1269755 Tractor gearing.

FEEDING AND HOUSING OF LIVESTOCK. — *Canada*: 183152 Animal holder.

*United Kingdom*: 115062 Horse blanket; 116318 Pig and poultry food from stomachs of slaughtered animals; 116357 Processes for producing a meal or flour from brewer's and distillers' grains.

*United States*: 1269346 Cattle stanchion; 1269943 Hog trough.

POULTRY FARMING. — *Canada*: 182779. Drinking fountain.

*United Kingdom*: 116318 Pig and poultry food from stomachs of slaughtered animals; 116560 Door opening device actuated by the weight of a fowl.

*United States*: 1267426 Incubator; 1268347 Egg case package; 1269874. Poultry drinking fountain; 1270756 Egg turner.

API CULTURE. — *Denmark*: 23110 Bee feeder.

*United States*: 1270507 Bee hive.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada*: 182822 Vegetable slicing and shredding machine; 183142 Flour sifter; 183179 Sap spout.

*Switzerland*: 78752 Drying apparatus.

*United Kingdom*: 116167 Fruit cleaning apparatus; 116233 Bottling machine; 116401 Sugar cane mill; 116521 Process of extracting sugar from canes; 116606 Apparatus for drying fruits, vegetables, seeds, fibres, etc.

*United States*: 1267419 Sugar refining apparatus; 1267655 Fruit drier; 1267776-1268398-1270733 Tobacco stemming machines; 1269412 Fruit and vegetable drier; 1269843 Method of canning maize; 1269966 Apparatus for the washing of raisins and the like.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *New Zealand*: 39782 Meat, etc., preservation by fumigation.

*United Kingdom*: 115009. Tanning process.

DAIRYING. — *Canada*: 182683 Churn.

*New Zealand*: 39856 Milking machine.

*Sweden*: 42636. Separator device; 42640 Discharge regulator for separator; 42783 Device for preventing excessive foaming in a centrifugal separator; 42854 Churn easily convertible into a separator; 42924 Device for joining cups and pipes in milking machines.

*Switzerland*: 78786 Churn mechanism.

*United Kingdom*: 115717 Churn; 116048 Milkcan.

*United States*: 1267920 Cheese press; 1268766 Churn; 1268792 Sani-

tary milk pail; 1269015-1270091 Milking machines; 1269348 Cream skimming device; 1270429-1270473 Pulsator for milking machines.

FARM BUILDINGS AND EQUIPMENT. — *Canada*: 182886 Gate; 182994 Wire stretcher; 183184 Ventilator mechanism.

*United States*: 1267863 Silo; 1268948 Fence gate.

VARIOUS. — *Canada*: 183146-183214 Pumps.

*New Zealand*: 39913 Germination of seeds testing box.

## RURAL ECONOMICS.

**1156—Influence of a City on Farming.** — ARNOLD, J. K. and MONTGOMERY, F., in *U. S. Dept. of Agric. Bulletin. No. 678* (Office of Farm Management), pp. 1-24. Washington, D. C., May 7, 1918.

This bulletin gives the results of a study of the agriculture of Jefferson County, Kentucky, a locality which is influenced greatly by a moderately large and growing city, Louisville. In response to a favourable and increasing market for vegetables, an increasing area of land is being utilised for market gardening. The raising of such crops as potatoes and onions has been profitable, principally on account of exceptional marketing facilities. The raising of cereals while still important has declined. The city offers an expanding market for dairy products, but by means of railways and tramways the city is quickly and cheaply reached by dairy farms located a long distance out, where cheaper land and other favourable conditions enable the farmer to compete successfully in the dairy market. With the growth of the city, the extension of trolley lines and the improvement of highways, an increasing number of people occupied in the city are living in suburban towns and in the near-by country. All these factors combined created a set of conditions which brought about rapid changes in agricultural practice.

Old types of farms, once dominant, are now disappearing, and new types are organised to profit by the opportunities offered. Farms that were once profitable as large units, under an extensive system of agriculture, come to be relatively unprofitable under new conditions creating higher values for real estate.

These conditions are analysed in this study in order to arrive at an understanding of the underlying principles of farm organisation and practice in the area surveyed, to point out the more profitable types of farming and to show how some of the more successful farms are organised.

*Sources of information and basis of study.* — In the autumn of 1913 about 50 farms were visited and a detailed study was made of the leading crop enterprises. In 1915 another farm-management survey was made of 100 farms in this area, within 20 miles from Louisville, representing various types, in which the organisation and the business success of each farm were carefully studied.

*The City and the County.* — The city of Louisville, on the Ohio River, occupies an area of about 28 square miles, and reached in 1916 a population of 267 342.

The city market place is operated by an association of farmers and business men.

The rural population of Jefferson County, including unincorporated towns was 38 992, showing an increase of 42.4 % during the preceding 10 years. During the same period the city population had increased 9.1 %. These figures indicate a rapid growth of suburban population. Outside of unincorporated towns the increase was over 30 %. Seven per cent of the population in 1909 was foreign born and 32 % of mixed parentage.

There were in 1909 3 093 farms in the county, an increase in ten years of about 9 %. During the previous decade the number of farms under 100 acres in size had increased 17 %, while farms over 100 acres in size had decreased about 14 %. During the same period the area devoted to the raising of vegetables had increased about 29% and the area devoted to cereals decreased about 22 %. Within the county during the decade 1899 to 1909 there was a marked decrease in the production of market milk, while three adjoining counties farther out with railway communications had a marked increase in milk sold. The decrease in Jefferson county was 43 %, while the increase in three outside counties was about 232 %. Jefferson county had a large increase in the amount of butter and cream sold, which to some extent made up for the loss in market-milk production. Butter, however, is made in small quantities as a by-product on nearly all types of farms, so that the increase in this product can not be said to make up the loss in market milk production. The census figures further show a decrease in the number of dairy cows in Jefferson County and an increase in the three outside counties during the same period.

*Soil and climate.* — The soil in the northeastern part of the county is a clay loam similar in character to the bluegrass soils farther east. The southeastern part of the county has relatively the poorest quality of soil, besides a portion which is hilly or mountainous. Much of the region, however, might be termed river-bottom land.

The climate is typical of that found in the lower elevations of the south-central States. The winters are comparatively wet, the highest average rainfall coming in March. The dry season begins in July and ends in November. The average growing season extends about 186 days, 200 days during the year being available for field work.

*The farm practice.* — Several types of farming are found in a radius of 20 miles from the city, representing two general systems of farm practice, the extensive and the intensive. The farms practising the extensive system are found toward the eastern part of the county and become more nearly typical as the bluegrass region is approached. These farms usually are large or medium-sized. The rougher and stony parts are kept in permanent bluegrass pasture. Orchard grass and clover are grown in rotation with grain and potatoes. Live-stock enterprises, dealing chiefly with beef cattle, dairy cows, sheep, swine and horses, are important. Irish potatoes, which often take the place of maize as an intertilled crop on these general farms, commonly occupy 25 to 50 acres.

On the smaller farms nearer the city the farm practice is entirely dif-

ferent. Nearly all the tillable area of these farms is planted in field truck crops, a very small percentage being left for pasture. Much of the land is double-cropped.

*Relation of distance from the City to Type of Farming.* — Table I indicates the influence that distance from the city has on the type of farming. Receipts from such field crops as maize, wheat, hay, hogs, and stock cattle are grouped in this table under the head "receipts per cent from other sources".

TABLE I. — *Relation of distance from city to type of farm.*

Distance from city	Number of farms surveyed	Size of farm acres	Rent of land per acre \$	Receipts per cent		
				From truck and potatoes	From dairy	From other sources
8 miles or less. . .	25	102	11.85	68	10	22
9 to 11 miles. . .	18	221	5.59	35	12	53
12 to 14 miles. . .	24	256	5.37	34	20	46
15 miles and over. .	33	257	4.66	20	27	53
<i>All farms</i> . . .	<b>100</b>	<b>211</b>	<b>6.80</b>	<b>38</b>	<b>18</b>	<b>44</b>

*The small intensive farms near the city are the most profitable.*

The relation of size of farm to operating expenses per acre and to land earnings per acre, with growing distance from the city, is illustrated in Table II.

TABLE II. — *Relation of size of farm to operating expenses per acre and to land earnings per acre.*

Size of farm	Number of farms	Distance from city	Average area of improved land	Operating expenses per acre	Gross receipts per acre	Land earnings per acre	Labour income	Profit on investment
<i>Acres</i>		<i>Miles</i>	<i>Acres</i>	\$	\$	\$	\$	%
Less than 80	21	9	44	73	96	23	1000	7
80 to 159	25	12	121	36	45	9	800	5.6
160 to 299	33	13	212	15	20	5	100	4
300 and over	21	16	420	14	18	4	140	4
<i>All farms</i>	<b>100</b>	—	<b>199</b>	<b>32</b>	<b>42</b>	<b>10</b>	—	—

The main reason for low profits on the larger as compared with the smaller farms is that many of the larger farms are not doing intensive enough agriculture to meet the new conditions brought about by a large and growing city.



*Distance from the city a factor in the value of land.* — As has been pointed out the building of good roads, the extension of tram lines, and the nearness of the city have made much of the land in this section desirable for other than agricultural purposes. Such conditions make the average market value of land higher than it should be for agricultural use alone. This is indicated in Table III.

TABLE III. — *Influence of the nearness of the city on the value of land and rent.*

Distance from Louisville	Number of farms	Rent of land per acre	Value of land per acre
Less than 8 miles . . . . .	25	\$ 11.85	\$ 312
9 to 11 miles . . . . .	18	5.59	110
12 to 14 miles . . . . .	24	5.37	106
Over 14 miles . . . . .	33	4.66	95
<i>All farms . . .</i>	<b>100</b>	<b>6.80</b>	<b>158</b>

*The effect of land value and nearness to city on the use of manure and commercial fertiliser.* — To some extent large quantities of stable manure are used by truck farmers in the vicinity of Louisville. The availability of manure at a reasonable price is one of the limiting factors in profitable truck farming in the vicinity of the city as shown in Table IV.

TABLE IV. — *The effect of land value and nearness to city on the use of manure and commercial fertiliser.*

Value of land per acre	Number of records	Distance to Louisville Miles	Size of farm Acres	Rent per acre \$	Value of farm manure and commercial fertiliser per crop acre	
					Barn manure \$	Commercial fertiliser \$
Less than \$ 80 . . .	23	16	284	5.50	3.75	0.60
\$ 80 to \$ 150 . . .	34	13	250	6.60	4.50	0.70
\$ 151 to \$ 200 . . .	22	12	188	8.75	4.60	1.90
Over \$ 200 . . . . .	21	8	95	15.00	18.00	1.25
<i>All farms . . .</i>	<b>100</b>	<b>12</b>	<b>212</b>	<b>8.60</b>	<b>7.35</b>	<b>0.90</b>

*Comparative study of types of farms.* — The foregoing tables show that there is a tendency for the farms to be smaller and more intensive near the city, while the farms 15 to 20 miles out are larger and raise general crops — maize, wheat, rye, bluegrass — and keep various kinds of live stock, such as beef cattle, dairy cows, sheep and hogs. These enterprises are the sources of farm receipts, usually pretty well balanced between crops and live stock. Such farms may be classified as the "general mixed type". If dairying becomes a dominant enterprise, with 40 % or more of receipts from milk or milk products, the farm may be classified as a dairy farm.

If 40 % or more of the receipts come from potatoes alone the farm may be called a potato farm ; if from potatoes and truck a potato-truck farm. These classifications are shown in Table V.

TABLE V. — *Relation of type of farm to size of business and labour income.*

Type of farm	Number of records	Acres of improved land	Value of capital invested	Total operating expenses per farm	Labour income
General mixed. . . . .	39	270	\$ 34 700	\$ 3 667	\$ 126
Dairy . . . . .	22	205	27 782	3 686	441
Potato . . . . .	11	192	35 000	3 715	333
Potato-truck. . . . .	24	62	20 000	3 950	1 350
<i>All farms</i>	<b>96</b>	<b>195</b>	<b>30 084</b>	<b>3 738</b>	<b>520</b>

The potato-truck type of farming is by far the most profitable of the 4 groups. This fact undoubtedly accounts in large part for the tendency towards more intensive farming. It must not be concluded that the potato-truck farms grow only potatoes and truck or that potato farms grow only potatoes. Other enterprises such as maize, wheat, dairy cows, hogs and sheep, have a place of more or less importance on most farms of these types. So also many dairy farms and general mixed farms handle enterprises characteristic of the more intensive types. Location with reference to the city, the soil and the transportation facilities are the principal factors determining the organisation of the more profitable type of farms.

*Distribution of capital on farms of different types.* — Table VI shows the amount and distribution of capital on the types of farms included in this study.

TABLE VI. — *Relation of type of farm to distribution of capital on 96 farms in Jefferson County, Ky. (values are averages).*

Type of farm	Number of records	Total capital	Market value of real estate	Working capital	Investment in live stock	Investment in machinery	Cash to run farm	Investment in work stock	Value of dwelling	Value of other buildings
		\$	\$	\$	\$	\$	\$	\$	\$	\$
General mixed . . . . .	39	34 700	30 589	4 111	1 977	722	785	1 050	2 619	1 626
Dairy . . . . .	22	27 782	23 247	4 535	2 911	697	448	661	2 950	2 349
Potato . . . . .	11	35 000	31 406	3 594	1 358	769	1 100	923	3 545	2 002
Potato-truck . . . . .	24	20 000	17 511	2 489	847	620	698	697	2 062	946
<i>All farms . . .</i>	<b>96</b>	<b>30 084</b>	<b>26 198</b>	<b>3 859</b>	<b>1 986</b>	<b>691</b>	<b>706</b>	<b>844</b>	<b>2 660</b>	<b>1 707</b>

*Distribution of crop area.* — Table VII indicates that about 50 % of the crop area on the average truck and potato truck farms is used in growing truck and potatoes, crops which represent intensive farming. The remainder of the area is used for growing maize, hay and miscellaneous crops, principally for feeding the work horses, dairy cows and hogs.

TABLE VII. — *The distribution of crop area on different types of farm.*

Type of farm	Number of records	Crop area in farm acres	Per cent of crops area in							
			Maize	Slage	Potatoes	Wheat	Hay	Truck	Miscellaneous crops	Green manure crops
Potatoes . . . . .	11	133	17.9	3.4	24.9	16.2	12.9	3.5	8.8	12.4
Potato-truck . . . .	12	60	15.2	—	29.6	1.2	12.2	24.1	8.2	9.5
Truck . . . . .	12	45	16.6	—	13.1	1.3	12.7	39.9	13.5	2.9
Dairy . . . . .	22	82	26.0	9.1	5.7	7.3	15.7	2.4	28.8	5.0
General mixed . . .	39	160	27.2	0.9	8.6	17.9	21.4	2.4	14.9	6.7

The distribution of different classes of animals on the different types of farms is as follows :— On the intensive types dairy cows, poultry, and swine are comparatively more important, while on the more extensive types, stock cattle, horses, and sheep are relatively more important. On the more intensive types of farms growing potatoes and truck, there is relatively a large amount of unmarketable products which, without stock to utilise them, would be wasted. Dairy cows, swine and poultry utilise these as well as the permanent pasture, and thus are profitable when in proper proportion to other enterprises.

The important conclusions drawn from this survey are :—

1) For the area surveyed the small farm intensively cultivated is the most efficient and profitable.

2) The most profitable types found are those specialising in potatoes and truck.

3) Dairying combined with truck farming is profitable, but as a type it is gradually being pushed farther away from the city to cheaper land.

4) The general mixed type of farm, representing the extensive system and a high degree of diversity, is the least profitable in this area.

Descriptions of several farms illustrating types found in this section are appended.

## AGRICULTURAL INDUSTRIES.

1157 — Research on Malting and a New Process for the Reduction of Malting Loss. — NOWAK, C. A., in *Pure Products*, Vol. XIV, No. 5, pp. 219-223. New York, May, 1918.

The principal object of the method is to eliminate as much as possible the invisible loss, the loss by respiration, caused by the transformation of carbohydrates into CO<sub>2</sub> and H<sub>2</sub>O and to check the excessive growth of

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the rootlet without retarding or preventing the full development of the acrospire. The annual invisible losses in United States breweries are estimated at over 2 million dollars.

A further object is to provide a malt high in acidity, specially adapted to the production of bottling beers. Moreover, this new method gives a malt which contains the principles necessary to yeast propagation, giving a healthy fermentation and constantly maintaining the yeast in strong condition.

The barley is sorted and cleaned in the usual manner, soaked in the steeping vats and aerated by passing air through the water, to which no lime or lime water is added, as this would neutralise the pre-existent acidity of the grain which it is the object of the method to preserve as much as possible. When the addition of lime is necessary, as in hot weather especially to prevent mould or premature decomposition of the steep water, chloride of lime should be added so that the steep water contains about 0.034 % of chlorine in solution.

After steeping, the barley at the flooring stage is sprinkled with a phosphoric acid solution containing not less than 0.1 % or more than 0.4 % acid, the concentration being dependent on whether the malt is to be used for brewing or distilling purposes. When the malt has reached the desired solution as judged by the development of the acrospire, not that of the rootlet, which may be delayed, it is put in the kiln.

The stimulating effect of the phosphoric acid upon the change within the grain is so marked that the flooring period may be shortened by 12 to 24 hours without there being any danger of obtaining a product poor in solution. This is a great advantage as the output of a malting plant may be greatly increased thereby.

The process requires no change in the equipment and produces a malt very rich in soluble extract and acidity. The high diastasic and peptic power of malt prepared thus is not due entirely to the action of the respective enzymes *per se*, but also partly to the hydrolysing action of the relatively strong acids on the peptones and carbohydrates. The comparative results are given of analyses of two malts prepared with the same barley, one by the ordinary method, the other by the new method. Malt treated with phosphoric acid gives about 1% more extract than untreated malt. The increase in acidity was 0.018 % of the total acid.

**1158 — The Capacity of Wheat and Mill Products for Moisture.** — STOCKHAM, W. L., in *Bulletin No. 120 of the North Dakota Agricultural Experiment Station*, pp. 97-131, + 10 Tables + 11 Diagr. Agricultural College, North Dakota, January, 1917.

The author has made a number of experiments on the influence of water on wheat and wheat products; the results are summarised as follows:—

1) The capacity or amount of water required to make a mixture of a given consistency of water and colloidal material is greatest when the component parts are in a state of equilibrium with each other.

2) The capacity of wheat and its products for atmospheric moisture and water increases as the physical equilibrium between the component particles is approached.

3) Wheat has a higher moisture capacity than any of its products. The natural capacity for water vapour of wheat and its products under the same conditions is as follows:— wheat 12.4 per cent, patent flour 11.31, bran 11.17, first clear flour 11.07, second clear flour 10.86, and shorts 10.5 per cent (the percentages of moisture are calculated on the dry weight of the samples at the beginning of the test). This is in the reverse order of their protein contents (the wheat excepted).

4) Starch prepared from patent flour has a higher capacity for atmospheric moisture than that from clear flour.

5) The capacity of wheat for atmospheric moisture is greater at zero than at higher temperatures, diminishing with increase in temperature. Above 60° C. it is dependent upon chemical changes which in turn are dependent upon the amount of moisture available. At the saturation point between 0 and 40°C. the theoretical limits are only one-third to one-half reached because of secondary changes produced by enzymes, bacteria and moulds.

6) Previously sprouted wheat absorbs both water and water vapour more rapidly than wheat in the natural state. It reaches its maximum sooner but does not reach as high a maximum as the normal wheat.

	Maximum moisture content Sprouted	Natural
Saturated atmosphere. . . . .	35.42 %	37.43 %
Immersed in water . . . . .	68.9	101.8

7) Wheat products have a more rapid rate of adjustment to modified moisture conditions than wheat and are more subject to secondary changes.

8) Germination does not take place from water absorbed from the atmosphere (condensation excluded).

9) The rate of change of the moisture content of wheat in the atmosphere or in water becomes slower as the maximum limits are approached.

10) In water (when growth does not take place) the capacity of wheat is greatest at zero, decreasing with increase in temperature until at approximately 60°C. hydrolysis begins. The rate of absorption is many times more rapid with the higher temperature. Before secondary changes have advanced noticeably a ten degree rise in temperature almost doubles the rate of absorption.

11) Secondary changes are nearly eliminated at zero. The losses are least at that temperature, amounting to only 5.5 per cent in 27 days. At 25° C. they amount to 23.4 per cent in 5 days.

12) The absorptive capacity of the wheat varies inversely as the water absorbing power of the flour produced from the same wheat, and as a rule inversely to the protein content.

13) The durumms are similar to hard red spring wheat samples of the same protein content in rate and quantity of water absorbed.

14) Pressure upon a water wheat mixture where either may change in volume at the expense of the other does not appreciably affect the rate

or amount of water absorbed by wheat where the secondary changes are eliminated or are slight.

15) Pressure upon the wheat itself diminishes markedly its capacity and rate of absorbing water.

16) A temporary variation of 5 per cent in the absorptive capacity of a flour may be produced by mechanical means alone. A much greater decrease, partly permanent in character, can be made by severe treatment.

17) The absorptive capacity varies with the protein content of flours of the same grade. This relation is not so marked between different flour ure; 5 grades.

18) The absorptive capacity of flour, starch, hydrolised starch, and bread is greatest at zero, decreasing with increasing temperature; 50 degrees makes a difference in absorption of from 16 to 24 per cent with these substances.

19) Sprouted wheat flour has on the average a 2 per cent lower absorption than that from the same wheat in the natural state.

20) Both normal and sprouted wheat flour increase in absorptive capacity during storage; in some instances as much as 3 or 4 per cent. The average increase of 34 samples in 8 months was 1.22 per cent.

21) The proportion of water in gluten is slightly higher under conditions which give it the greatest freedom during its formation, *i. e.*, with higher temperatures, or with more water at its disposal.

22) Approximately 180 per cent of water is absorbed by gluten and once it is formed it retains practically a constant amount of water at all temperatures below its decomposing point.

23) Tho absorption of a starch gluten mixture is less than the sum of the absorption of the two taken separately.

24) By hydrolysis starch has its capacity for water doubled. By dextrinisation it is markedly decreased.

25) By baking or by decomposition gluten has its capacity for water decreased. Baked gluten does not vary in water capacity with change in temperature.

26) The maximum staleness of bread occurs when the ratio of water present in the bread to the capacity of the starch is least, or the fresher the bread the more nearly satisfied with water are its starch particles and with a given moisture content this satisfaction would vary with the temperature changes inversely as the absorptive capacity of either starch, hydrolysed starch, or bread.

27) The capacity for moisture of the inner portion of the bread indicates that practically all of the starch is hydrolysed during the baking process. That of the crust is less, indicating some dextrinisation.

28) The higher the starch content of a flour the more water would it require in proportion to its capacity to produce a loaf of a given apparent freshness.

1160 — **The Decortication of Peanuts.** — I. MATHON, E., Rapport tendant au décortilage des arachides du Sénégal (Report on the Decortication of Peanuts from Senegal), in the *Institut Colonial de Marseille, Section des Matières Grasses, Bulletin*, No. 2, pp. 3-13. Marseilles, 1917. — II. Peanut Decorticating Machines, *Ibid.*, *Bulletin* No. 4. Marseilles, 1918.

I. — The annual peanut crop of French Senegambia alone varies from 250 000 to 300 000 metric tons with an average volume of 106 cu. ft. per metric ton. More than  $\frac{2}{3}$  of this amount has to be removed quickly, before the first rains, as the existing stores cannot hold more than 100 000 metric tons, though they have been considerably enlarged the last 2 or 3 years.

In normal times the ordinary shipping lines did not suffice for this trade and recourse was had to Scandinavian boats lying idle at home at the period when extra tonnage was required for Senegal. Now, this no longer takes place and the question of shipping peanuts from French West Africa is of prime importance. What is required is that the yield of the ship placed at the disposal of the importers should be increased by decorticating the peanuts.

One thousand lb. of peanuts in their shells, as they usually are exported, include 700 lb. of seed, 260 to 270 lb. of shells and 30 to 40 lb. of earth, straw, sand, etc.

The specific weight is 652 to 706 lb. per 100 cu. ft. of peanuts in their shells and 1266 to 1287 lb. per 100 cu. ft. of decorticated peanuts. Again, on a ship 500 lb. of loose undecorticated peanuts take the same space as 800 lb. of decorticated nuts in sacks. Thus the carriage of 100 000 tons of decorticated nuts would give an economy of 56 % over 100 000 tons of undecorticated nuts. It is evident, therefore, that the tonnage of ships required for transporting the decorticated nuts from Senegal would be only one half that required for transporting the same quantity of nuts.

How can this result be arrived at? In countries that usually export decorticated nuts, the natives decorticate them (India, East Coast of Africa). In Senegal this is not the case and machinery would have to be used; but machinery breaks many nuts, which does not matter if the nuts are used at once, but which is of great importance if the operation is carried out for the purpose of transport. The question of power or hand (for home use) machines is being studied at the Colonial Institute at Marseilles.

Up to the present the rise in freights had damaged the producers by lowering the selling price. Now the increased freights will be profitable to them when decorticated peanuts are shipped, for they will allow of an increased buying price. The author thinks there is no fear of painting the benefits of this in too bright colours to the natives in order to stimulate them in the work of decortication. The expenses will be largely covered by all sorts of advantages, such as the profit, which will be considerable for the natives, who will be better paid; the Colony, whose prosperity will be increased by the extension of its crops and the greater prosperity of its inhabitants; the railways, which will have more traffic; the commercial men whose stocks will be better maintained by the same number of steamships; and even the consumers, on account of the decreased cost price. In addition, the warehouses, with the same capacity will be able to store more,

so that the exporting season can be lengthened; the seeds sold will be freed from the always increasing amounts of impurities; the buying season, obligatorily reduced to 5 or 10 weeks can be lengthened slightly; the ships will not be idle so long in the ports as a sacked cargo can be loaded more quickly than a loose one.

II. — The Fats Section of the Colonial Institute at Marseilles gives a description of the modern machinery known to it for decorticating peanuts.

There are 2 types of decorticators: one decorticating between a grooved cylinder and a grooved scraper, the grooves varying in form and direction according to the type of machine (those of ARMAND & DÉOUNE, Marseilles, and some American machines); and one with a threshing machine (GAUDART machine), a type employed in India.

Messrs ARMAND & DÉOUNE, of Marseilles, make two types: — one gives a yield per hour of 1041 lb. of decorticated peanuts ready for sale, and 55 lb. of broken kernels, etc.; the other is on a bigger scale, and gives 3300 to 4400 lb. of decorticated peanuts. The large machine includes, as well as the usual machinery, a fan that removes the seed-shells, straws, stones, etc.

M. R. GAUDART, of Paris, makes peanut decorticators with threshing organs of which the type B3 gives the best results. A machine has been installed in the buildings of the Madras Presidency Agricultural Department, for demonstration to the natives. This machine — type B3 — can deal with from 2200 to 2640 lb. of undecorticated peanuts per hour, working continuously according to the degree of dampness of the grain. Eight H. P. are required to run the machine at 180 revolutions a minute. The seeds broken vary from 5 to 15 % according to the degree of humidity. This machine may be installed in groups of 2 or 4. A group of 2 decorticators with a double-fan winnowing machine can treat 25 metric tons of undecorticated peanuts giving 18 tons (75 %) of decorticated seeds; 2 H. P. and 11 workmen will be necessary. Two groups united form a plant that can produce about 77 000 lb. of decorticated peanuts per day; 50 H. P. and 20 workmen would be required. In India Messrs BEST & Co., of Pondicherry, make the GAUDART machines.

Messrs ROSE, DOWNS & THOMPSON, Ltd., of Hull, make cylinder decorticators that are made rather for oil-works where peanuts are pressed. The machines are in 4 sizes: — No. 200, with a sieve, treating 1 metric ton of peanuts per hour; No. 201, idem, treating  $\frac{1}{2}$  that amount per hour; No. 202, idem, treating  $\frac{1}{4}$  that amount per hour; and No. 203, worked by hand or power, treating 165 lb. per hour. Messrs BAERLEIN & SONS, of Manchester, offer the same machines as the preceding ones. The HUNTLEY MANUFACTURING Co., of Silver Creek, N. Y., U. S. A., makes the "Monitor Houston" of the thresher type with a capacity of about 1100 lb. per hour.

The APPOMATTOX IRON WORKS & SUPPLY Co., Petersburg, Va., U. S. A., make several machines that deal with from 6600 to 16 500 lb. in 10 hours; the machines decorticate the nuts and remove the shells by a current of air. This Company makes 2 small cylinder machines: — "Appomattox", No. 0, of 1100 lb. capacity in 10 hours, and No. 3, of 3300 to 3850



lb. capacity per 10-hour day. The last-mentioned machine sorts the separated shells into 3 grades.

The CARDELL MACHINE Co., of Richmond, Va, U. S. A., makes cylinder decorticators and separators of various sizes, driven by hand (10 to 15 sacks per hour) or power (150 sacks per day).

The JOHNSON & FIELD MANUFACTURING Co., of Racine, Wis., U. S. A., makes power-driven machines of various sizes for separating and sorting the peanuts as well as sacking them by means of an elevator.

**1161 - Vinegar from Waste Fruits.**—CRUESS, W. V., in the *University of California College of Agriculture, Agricultural Experiment Station, Bulletin No. 287*, pp. 169-184 + 11 Figs. Berkeley, California, October, 1917.

Fruit unsuitable for sale fresh, for drying or for canning, may often be used for the manufacture of vinegar or acetic acid, from which is obtained acetone, used in the manufacture of high explosives. One ton of apples, grapes, or most deciduous fruits, will yield from 140 to 175 gallons of juice suitable for the making of vinegar; oranges yield about 100 to 125 gallons. Apples give about 75 lb. of acetic acid per ton, grapes about 150 lb., and oranges about 50 lb. In California, at 15 cents per gallon, vinegar from one ton of apples or grapes is worth approximately \$ 23, and from a ton of oranges about \$ 15. Estimating the value of acetone at \$ 2 per gallon, the acetone from one ton of apples is worth about \$ 7, that from 1 ton of grapes about \$ 13, and from one ton of oranges \$ 4.50.

The profits from the manufacture of vinegar are moderate. There is a demand for acetone, but its manufacture requires a special installation and should only be undertaken on a large scale and where a large supply of cheap fruit is available.

The author studies the principles of vinegar production rather than equipments on a large scale, but if the principles examined are well understood they may easily be applied to manufacture both on a large or a small scale. All the common fruits, with the exception of lemons, and inferior quality dried fruits may be used for the manufacture of table vinegar so long as they are sound and clean. For making acetone the condition of the fruit is of no importance. Cannery waste (peel and cores) give satisfactory vinegar if sufficiently clean, otherwise they may be used for the manufacture of acetic acid or acetone.

The crushing and pressing of the fruit, fermentation, clarification, bottling and diseases of vinegar are described successively. Most fruits can be pressed most satisfactorily if previously crushed and fermented. Vinegar making depends on two fermentations; in the first the sugar is turned to alcohol and carbonic acid by yeast; in the second the alcohol is turned into acetic acid by acetic bacteria. To obtain good results the two fermentations must be made separately. Pure yeast (the preparation of which is described) and a small amount of sulphurous acid must be used to insure good alcoholic fermentation and to eliminate lactic bacteria.

The fermented juice should be kept for two or three weeks to free it from the yeast and other solid particles and should be decanted before acid fermentation begins. To the racked juice should be added  $\frac{1}{4}$  its.

volume of fresh vinegar to start the acid fermentation and prevent diseases. The fermented acid juice may then be made into vinegar by the slow process in barrels or by the rapid process in generators (fixed or rotating) which are fully described and illustrated. The vinegar should then be aged (1 year for the best quality). During this process it may clarify sufficiently to be bottled for sale, but usually filtration or the addition of some clarifying substance is necessary.

**1162 - The Scott Process and Plant for Drying Potatoes.** — See No. 1152 of this Review.

**1163 - Straw Hats and Braids in South America.** — *The South American Journal*, Vol. LXXXIV, Nos. 18, 19, 20, pp. 281-282, 299, 315-316. London, May 4, 11, 18, 1918.

**ARGENTINA.** — Straw hats are worn generally in Argentina from October to May. According to Mr. ROBERTSON, the U. S. Consul General at Buenos Ayres the wholesale prices in 1914-15, according to the shape and quality, were 30 s to 78 s per dozen for "canotiers". 5 s. 6 d. to 62 s. per dozen for round crowned hats for men, 11 s. 6 d. to 24 s. per dozen for round crowned and sailor hats for children, 30 s to 84 s. per dozen for black rustic straw hats. During these years the retail price depended on the stock in the market, and varied from 4 s. 6 d. to 10 s. 6 d. each. In September, 1917, the prices exceeded those of 1914-15 by £ 1 per dozen.

Before the war the proportion of imported hats was about 200 % of the national production. Argentina produces from 24 000 to 31 000 dozen straw hats annually. The machinery used is of foreign origin; the presses come from France and Italy and the sewing machines from Germany and North America.

The importation of straw braid rose from 55 118 lb. valued at £ 4 500 in 1915 to 81 095 lb. valued at £ 6 150 in 1916. Previously these imports came from Germany, France, Italy, Switzerland and England, but now they come from England and Switzerland. No special fibre suitable to the manufacture of straw hats is known in Argentina, but it is probable that no special study has been devoted to this subject.

**BRAZIL.** — Straw hats are worn practically throughout the whole year though felt hats are also worn during the winter months. Stiff straw hats are mostly worn in the towns; labourers working in the open wear very cheap soft straw hats. Panama hats are in very small demand. Hats for women are usually made of horsehair or vegetable crin, which are believed to come from China or Japan.

Practically all the imported straw hats come from Italy. The imports were estimated at £ 15 800 in 1913, £ 5 200 in 1914, £ 2 300 in 1915, £ 950 in 1916. In 1915 there were 269 hat factories in the State of San Paulo, only 6 of which are important. These factories also make felt hats. In 1915 1 012 594 hats valued at £ 400 000 were produced, in 1916 1 200 000. The only machines used in these factories are sewing machines, mostly of German make.

The straw braid comes from Switzerland ( $\frac{3}{4}$ ) and Italy ( $\frac{1}{4}$ ). In 1913 the imports were 53 533 lb. valued at £ 12 000; in 1914 they decreased,

rose slightly in 1915, and in 1916 were 48 847 lb. valued at £ 14 000. Nearly all the braids are sold in lengths of 60 yds. Very little dyed braid is sold. All these quantities are imported through the port of Santos ; those imported through Rio de Janeiro are not known. The native production is limited to coarse braids used for making labourers' hats. A few native hats are woven from fibre made from plants growing in the country.

URUGUAY. — Straw hats are largely worn in the towns by the upper and middle classes, but much less so by the working classes. The number sold annually is estimated at 8 000 dozen for men, 3 000 dozen for women, and 10 000 dozen for children; 80 % of these hats is manufactured locally, the remainder are imported. In 1915 fine straw hats to the value of £ 1 060 were imported from Great Britain (460 doz.), Italy (128 doz.), France (11 doz.); cheaper qualities come from Italy (1 034 doz.), Great Britain (961 doz.), France (21 doz.), Argéntina (20 doz.), Spain (12 doz.); their value is estimated at £ 2 300. The straw-hat industry has made great strides in Uruguay during the last two years, largely owing to the import duties imposed in 1915. The present annual output is estimated at 16 000 to 20 000.

All the straw braid used by the factories is imported, the quantity being estimated at 120 000 to 150 000 pieces of 50 metres of an approximate value of £ 4 000. The braids come from Japan and Italy; in both cases they are imported through England or France, where they are bleached. Bleached straw is most largely in demand for men's hats, Tagal straw 4 to 5 mm. wide is preferred for women's hats. All transactions are done at 6 months' credit, and it is clear that exporters demanding cash would be at a great disadvantage against competitors giving credit.

PERU. — There is but a small market for braid in Peru as 50 % of the straw hats are made in the country. It is very difficult to obtain statistics on this industry. The straw hats manufactured annually are estimated at 80 000 dozen, 25 % of which are servants' or bathing hats. In 1915 75 % of the importations came from Italy, 15 % from Great Britain, and the rest from France, Chile and the United States. No statistics are available for 1916. The straw-hat season along the coast lasts 7 months, but inland straw hats are worn throughout the year. The Indian population wear servants' or bathing hats, or cheap Panama hats made in Ecuador or the north of Peru. There are four straw hat factories in Peru; the presses used are of Italian make, the sewing machines English or German.

VENEZUELA. — Cheap hats are usually made by hand and sold to the working classes. Nearly all the straw hats are made locally, the import duties being prohibitive. Statistics on the importation of straw hats are not available. The centre of the native production is at Valencia, where there are three factories working with a total annual output probably below 100 000 hats. The machinery used is Italian and American. Near Coro cheap hat making is a home industry; the women plait palm straw and make of it hats which sell at 4 s a dozen. There are no statistics showing the amount of raw material imported. Nearly all imported braid is bleached, preference being given to that from Europe rather than that from the United States.

COLOMBIA. — Straw hats are worn all the year round. Panama hats are made from native grasses in the interior, but the better quality hats are more expensive than the imported ones which have increased in popularity of recent years. Two small hat factories have been started at Barranquilla and Cartagena. The Barranquilla factory has 15 sewing machines worked by electric power and four presses, and has an output of 25 dozen hats a day. The prices vary according to the quality from £ 2 to £ 5 per dozen. Retail prices are from 4s upwards. All the materials used in these factories are imported from the United States, though the braid originally comes from Italy, China, and particularly Japan. The annual imports amount to 16 000 pieces of 60 yds. Both soft and stiff straw hats are made with various kinds of braid and compare favourably with the imported hats.

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1164 — **The Condensed Milk Industry in Japan.** — Abstract from the *Jiji Shimpoo*, April 23, 1918 in the *Department of Trade and Commerce, Canada, Commercial Intelligence Branch, Weekly Bulletin*, Vol. XVIII, No. 750, pp. 893-894. Ottawa, June 10, 1918.

The use of condensed milk in Japan probably dates from 1880. The condensed milk imported into Japan at one time amounted to 1 200 000 dozen cases with a value of 4 500 000 *yen* (£460 323). Since then a condensed milk industry has developed in Japan. The produce, of inferior quality at the beginning, has improved considerably and can now compete with foreign condensed milks and is being exported in large quantities.

The centre of this industry is at Mishima, in the prefecture of Shizuoka. There are 2 776 dairy cows, 1 000 of which supply approximately 40 *koku* (1600 gallons) of milk daily. To prepare one case of condensed milk (4 dozen tins per case) 33 *sho* (52.14 gallons) of raw milk are necessary. The factory, therefore, is able to produce about 3 600 cases a month.

The conditions in Japan are excellent for the production of condensed milk, the quality of which depends on the climate, the drinking water and the fodder. The local farmers undertake cattle breeding as a secondary occupation, devoting much care to it.

A table giving the production, importation and exportation of condensed milk in 1913, 1914, 1915 and 1916, shows that local production has increased greatly and that the importation has dropped considerably though the exportation has continued to increase. At the present time Japanese brands of condensed milk are quoted at \$ 9 to \$ 9.60 per case of 4 dozen tins, whereas the imported brands sell at \$ 10.87 to \$ 11.25 per case. An analysis made by the Hygienic Laboratory of Japan showed the quality of Japanese condensed milk to be superior to that of foreign brands.

1165 — **The Reducing Ferments of Milk.** — PERRIAZ, J., in the *Archives des Sciences Physiques et Naturelles*, Year CXXIII, Period 4, Vol. 46, pp. 101-102. Geneva, 1918.

In order to study the reducing ferments of milk the author took samples direct from the byre and treated them immediately so as to avoid the subsequent action of reducing ferments. The method employed was as follows:— 10 cc. of milk diluted with sodium nitrate and acetic aldehyde are left for one hour in an incubator at 60°; the serum is filtered, lead sub-

acetate added, and again filtered. It then contains reducing ferments, estimated as  $N_2O_3$  with a titrated solution of sulphanilic acid and acetic naphthylamine.

RESULTS. — 1) There is no connection between the very minute quantity of reducing ferments and the natural components of milk — water, casein, sugar, albumin, etc.

2) The quantity of these reducing ferments depends on the following factors:— *a*) the animal species; the milk of mares and asses is richer than that of cows, goats, or sheep; *b*) the system of feeding and the food; mountain hay gives milk very rich in ferments, beet and cake very poor milk; *c*) the age of the animal; young animals give very poor milk, old ones a much richer milk. At the beginning of milking the milk is almost devoid of reducing ferments (0.08 mgm. per 10 cc.) whereas this content increases very greatly towards the end.

3) Boiling causes these ferments to disappear *completely*; they are destroyed by temperatures between  $75^{\circ}$  and  $80^{\circ}$  C. It results that sterilisation removes from milk a very important element of its digestibility.

#### 1166 — The Churning of Sweet Cream and Acid Cream: Investigations in Sweden (1).

— HESSELBERG, O., in the *Nordisk Mejeri-Tidning*, Year XXXIII, No. 13, pp. 267 269. Stockholm, June, 1918.

The author seeks to determine whether it is more advantageous to churn sweet cream or acid cream. Of late years the production of butter has assumed more and more the character of an industry the technique of which demands the most modern ingredients and methods, such as pasteurisation, the use of pure lactic ferments, etc., and all improvements in technique have always been concerned with the churning of acid cream. Moreover, should there be any defect in flavour, the consumers, always very exacting in this respect, never fail to impeach the churning of sweet cream should the dairy adopt this method.

To what extent is the preference for acid cream justified? The two principal factors in the production of butter are yield and quality. The maximum average yield which may be obtained from 100 lb. of milk (with 3.5 % of fat) by churning acid cream may be calculated by means of the following data:— cream 12 lb., skim milk 86 lb., buttermilk 8 lb.; fat content of skim milk 0.08 %; fat content of buttermilk 0.50 %, fat content of butter 81 %, moisture content of butter 15 %.

It is seen that the fat content of skim milk is  $\frac{0.08 \times 86}{100} = 0.069$  lb., that of buttermilk  $\frac{0.50 \times 8}{100} = 0.040$  lb., or a total of  $0.069 + 0.040 = 0.109$  lb. which must be subtracted from the fat content of the 100 lb. of milk used ( $3.5 - 0.109 = 3.391$  lb.). The butter yield from these 100 lb. of milk obtained by churning acid cream is, therefore,  $\frac{3.391 \times 150}{81} = 4.186$  lb.

When sweet cream is churned the calculation is somewhat different.

(1) See also R. July, 1918, No. 819. (Ed.)

The amount of cream (12 lb.) and skim milk (86 lb.) remain the same, but as the butter-milk is very fat in this case it has to be skimmed again and its fat content is decreased (0.3 %). The butter from acid cream seems slightly richer in albuminoids and, consequently, the fat content of butter from sweet cream may be slightly higher. The moisture content may be adjusted in both cases. The average yield of 100 lb. of milk (with 3.5 % of fat) obtained by churning sweet cream may, therefore, be calculated by the following data:—cream 12 lb., skim milk 86 lb., buttermilk 7.3 lb., buttermilk obtained from the "buttermilk cream" (kärnnyölkefter kärnnyölksgrädden, second churning) 0.7 lb., fat content of skim milk 0.08 %, fat content of buttermilk 0.30 %, fat content of buttermilk obtained from the "buttermilk cream" 1.0 %, fat content of butter 81.3 %, moisture content of butter 15.0 %.

There are 0.069 lb. of fat in the skim milk, 0.022 lb. in the buttermilk and 0.007 lb. in the buttermilk from the "buttermilk cream", or a total of 0.098 to be deducted from the fat content of the 100 lb. of milk used (3.5 — 0.098 = 3.402 lb.): The yield in butter of 100 lb. of milk obtained by churning sweet cream is, therefore,  $\frac{3.402 \times 100}{82.3} = 4.184$  lb.

*The yield is, therefore, almost identical in both cases.*

The method usually adopted in churning sweet cream is as follows:—the butter-milk is skimmed and the cream obtained added to the other cream obtained during the day. This is a great mistake from the point of view of both yield and quality. If, on the other hand, the "buttermilk cream" is churned a second time one week later, when it is "ripe" the yield is excellent.

The advantages of churning sweet cream are:—

- 1) it is unnecessary to acidify the cream;
- 2) defects in quality due to the acidification of the cream are avoided;
- 3) butter made from sweet cream keeps much better than that made from acid cream; the author showed that, in the first case, butter was perfectly fit for consumption even after two or three months, whereas, in the second case, it deteriorated after fifteen days; these superior keeping properties are seen especially during the summer and autumn months.

**1167 — The Preparation of Home-made Rennet.**—TODD, A., and CORNISH, E. C. V., in *The Journal of the Board of Agriculture*, Vol. XXIV, No. 3, pp. 307-312 + 3 Tables. London, June, 1917.

The method described is as follows:—to 1 gallon of brine filtered through paper or muslin and 2 oz. of boric acid are added 15 vells freshly split and washed, which are left to soak for one week in a cool place, the mixture being stirred daily. When the mucous membranes are soft they are scraped off and returned to the original extract (first steep), which is kept till it attains a suitable strength. It is then filtered through cotton-wool and the rennet bottled and kept in a cool, dark place. The scraped vells are placed in half the original quantity of fresh brine (second steep) and the extract, though much weaker than the first, is treated in the same manner.

The strength of extracts obtained by this method compares favourably with that of commercial rennet and they retain their coagulating properties for several months, their strength often increasing with keeping. Over 1 300 gallons of milk were made into entirely satisfactory cheeses by the use of these extracts.

1168 - **The Preservation of Meat: Researches on the Presence of Living Elements in Normal Muscular Tissue (Parasitism and Microbiosis).** — GALIPE, V., in the *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 178-180. Paris, 1918.

Many workers (BÉCHAMP, NENKI and GIACOSA, BILLROTH and FIEGEL, BURDON-SANDERSON, GAUTIER and ETARD) have demonstrated the presence of living elements in muscular tissue and the autonomous persistence of intracellular life. The author, having carried out further work on the question, gives his conclusions which are of interest from the standpoint of food hygiene.

Pieces of meat of even the best appearance are colonised not only on their surface but internally, as much on account of normal and accidental parasitism as on account of the activity of microbiosis. The progress of microbiosis is favoured by attrition, whether experimental or accidental, of the muscle tissue, thus decreasing its capacity for preservation. Meat juice extracted under heavy pressure is rich in microorganisms and micro-enzymes (*microbiose*). The colonisation of butcher's meat, which can take place 2 to 3 hours after slaughtering, is so rapid that it is impossible to accept the common theory according to which microbial colonisation takes place solely from exterior to interior through the parasites deposited on the meat during handling. Other causes, as yet unknown, probably play a part (*e. g.*, attrition during dressing which might favour the development of microbiosis close to the muscular tissue). Perhaps the method of slaughtering may have an influence. Fragments of muscular tissue of a healthy animal were removed under strictly aseptic conditions; 3 days after inoculation, the cultural centres were found to be colonised and others gave positive results after 48 hours. These muscular tissues only decomposed after 22 days, but gave off no odours of putrefaction. In consequence handling meat under conditions of irreproachable cleanliness is most desirable and would greatly diminish the proportions of poisoning due to meat. In his cultures the author found mitochondrial forms resembling the condriocontes described by GUILLERMOND in the epidermis of the tulip and by MULON in a cell of the supra-renal capsule of the guinea-pig, as well as spores and mycelial tubes. The author attempted to ascertain if chilled meat was less contaminated or not than fresh meat; a fine-looking piece of chilled meat of excellent taste was found to be colonised just as much as that coming from the slaughter-house, and cultures gave positive results after 24 hours. These results were again due to normal and accidental parasitism and microbiosis. In consequence refrigeration does not destroy those microorganisms deposited on the surface of the meat during handling any more than it does those the meat usually contains; it can slow down or suspend the activity of the different microbical elements in proportion to the lowering of the temperature, but the activity recommen-

ces as soon as the cold ceases. From the standpoint of the preservation of food stuffs the action of heat may be compared to that of cold.

**1169 - Food Preparations Made with Blood and Meat Mixed with Yeast.** — GANDUCHEAU A., in the *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVI, No. 25, pp. 1058-1059. Paris, 1918.

Under present conditions it would be very advantageous to use the blood and intestinal organs, generally wasted by the slaughter-houses, to a greater extent for human consumption than has hitherto been the case. The author proposes a new food prepared from this waste as follows: — the blood of pigs, oxen and horses is taken under special aseptic conditions from the slaughter house as soon as possible after the animals have been bled and successively heated for coagulation of the albumens and disinfection; it is then crushed and fermented with a pure culture of beer yeast (fermentation under slightly acid conditions in the presence of a small quantity of starch sugar obtained from rice, potato, pea-shells etc., by warm diluted hydrochloric acid). After a few hours at a maximum temperature of 20 to 25°C the pasty mass ferments and a microscopical examination shows the presence of pure yeast cultures.

The paste thus obtained, strongly modified by the action of the yeast, is not so compact as that of black-pudding or other similar products, and has numerous small holes caused by the gas formed during fermentation. The porous product is thus more easily acted upon by the digestive juices. Visceral tissues when finely crushed previously may be prepared in the same manner as blood.

With respect to the application of bread fermentation to blood and meat, a subject already treated in previous papers (SCHEURER-KESTNER, *C. R. Acad. des Sc.*, 1880, p. 369 and CHARDIN, *ibid.*, 1890, p. 670), the author points out that the materials used (bread made with mixed flours, leaven, hashed meat and blood) were bacteriologically impure and, as they were not heated before fermenting the leaven had combined with the yeasts and bacteria, a disadvantage incurred also in the oriental process in which mixed meat and bean pastes are used.

For this reason the technique used in fermenting albuminoids should be rigorous and, above all, pure cultures should be used. "Risen" blood paste is excellent for making sausages and pastry, and gives products with a very good flavour. Blood and flour biscuit is a complete food of small bulk and the author believes that the use of the blood from slaughter-houses may prove very interesting from an economic point of view.

**1170 - The Preservation and Efficient Ripening of Silage in Warm Countries: the Use of Hydrochloric Acid or other Acid Mineral Substances and Special Substances** — GIGLIOLI, J. (Professor of Agricultural Chemistry, University of Pisa), paper read before the International Association for Tropical Agriculture, Third International Congress of Tropical Agriculture held at the Imperial Institute, June 23 to 30, 1914. Reprinted from the *Transactions of the Congress*, Vol. II, 29 pp. + Bibliography of 30 Publications. London, John Bale, Sons and Danielsson, Ltd., 1917.

In warm, dry countries ensilage is more useful even than in mild, damp climates, 1) because of the long summer without green fodder;



2) because of the lower value of hay resulting from its more rapid drying, and 3) the waste material from bushes and wild plants which dries badly and needs a special fermentation process before cattle will accept it. Preservation in silos is much more difficult in hot than in temperate climates. So that the material in the silo shall change little and slowly the use of salt (denatured for cattle) has been advised but little used. Several methods have also been tested: — 1) Steaming the ensilage; 2) heating, cooking, inoculation with lactic ferments; 3) addition of molasses or sugar; 4) treatment with special antiseptics, such as carbon bisulphide, etc., 5) treatment with acids, especially mineral ones, or with mineral acid substances.

1) STEAMING. — Tends to keep the acidity of the ensilage low and makes it easily apt to spoil when the silo is open; it is also expensive and not always easy to apply.

2) INOCULATION WITH LACTIC FERMENTS. — The bacteria consume very actively a large part of the organic matter of the silage so that, from this point of view it is best to eliminate them completely. On the other hand they assist in the production of the total acidity of the fodder in the silage which, being more useful the more fixed it is (as, e. g., when it is produced by lactic acid), has a protective action against the most harmful anaerobic bacteria and especially against all those which tend to develop rapidly before the silo is completely filled and when it is opened. It is for this reason that a predominance of lactic ferments is encouraged by adding cultures of them to green fodder in filling the silo. The pulp of sugar beet is well suited to this treatment and has been used in France where a product "lacto-pulpe" for inoculating beet pulp and other fodder for ensiling has been put on the market, in Austria, where pure cultures of acid-producing bacteria for this inoculation are sold under the name of "Vindobona-Pulpe", in Connecticut, U. S. A., and in Italy as a result of the work of Prof. GORINI (1). In warm countries, however, the use and transport of bacterial cultures over long distances are rather unsafe, the fermentations of the fodder are more complex and heterogenous, so that the one which should predominate is not sure to do so, etc. For all these reasons it seems more rational, to assure the protective action of acids, to add the acids to the fodder in the most unchangeable and efficient form, that of mineral acids, instead of waiting till the bacteria, as a result of their complex actions, evolve an acid which ferments more easily.

3) ADDITION OF SUGAR. — The addition of molasses was tested by Dr. SAMARANI at the cheese-making Station of Lodi, as a complement to inoculation with lactic ferments on a basis that the presence of sugar favours lactic fermentation at the expense of butyric fermentation. The author notes that: 1) the addition of molasses, from this point of view, should be necessary for leguminous fodders poor in sugar but rich in protein; 2) in warm countries it is best to use molasses in much larger quantities to take advantage of their antiseptic properties and high food value in association, not

(1) See R. 1915, Nos. 541, 923, 1145; R. 1916, Nos. 109, 232; R. 1918, Nos. 473, 918. (Ed.)

with the inoculation of lactic ferments, but with hydrochloric acid, in quantities corresponding to the acidity of a good acid silage, for example, 2 %.

4) ANTISEPTIC TREATMENT. — The use of carbon bisulphide for preserving silage, proposed in 1887 by Dr. GRETE (Zurich, Switzerland) and successfully tested with clover the same year (1 cc. per litre of capacity of the silo), was later tested with good results in Haute-Garonne, France (carbon bisulphide in Jemain capsules, 5 lb. per metric ton of crimson clover), in Sweden, and in Russia (red clover, cabbages, carrots). Carbon bisulphide inhibits to a marked degree the development of free organic acids in the silage. It would be well to test it or carbon tetrachloride in warm countries. In fodder containing cyanogenetic substances (sorghum, for example) the vapour of carbon sulphide or tetrachloride, by giving rise to enzymic actions, might cause the liberation of hydrocyanic acid; the question, therefore, calls for further study.

Dr. GRETE also experimented with sulphur dioxide; these tests should be repeated in warm countries. This gas has a triple action:— a) it inhibits oxidation; b) it stops bacterial action and the development of moulds, and probably lessens all enzyme action; c) by oxidising it forms sulphuric acid, which would keep the silage unchanged till it is taken to the stables.

5) TREATMENT WITH ACID SUBSTANCES. — The author proposed the use of acid substances, especially mineral acids, many years ago at the High School of Agriculture at Portici, Naples. In an experiment, he added to maize silage, besides common salt, 2 % of an organic acid substance (citric acid, tartaric acid, or cream of tartar). In another experiment he watered the fodder as it was being put into the silo with 5 % hydrochloric acid or commercial hydrochloric acid diluted with 10 volumes of water (this method could also be used for preserving mulberry leaves for silkworms). Before giving fodder preserved with hydrochloric acid to stock it must be moistened with a solution of sodium carbonate, which neutralises the acidity and seasons the fodder with sodium chloride. The action of hydrochloric acid could be combined with that of sulphur dioxide by means of sodium bisulphate.

At Perugia, Italy, Prof. SANI successfully used, in 1912, monocalcium phosphate (300 gm. per quintal of fodder) by spreading it over clover as a big iron silo was being filled.

In 1885 WEISKER showed that a limited quantity of mineral acids in the fodder is not injurious to stock. On the other hand, it is easy to remove excessive acidity from fodder when it is fed by sprinkling with sodium carbonate or powdered lime. This is good for milk production and small quantities of calcium chloride help the growth of animals.

The author believes hydrochloric acid to be preferable to sulphuric acid; the first is naturally in the gastric juice and, by neutralisation gives salts preferable to sulphates. Sodium chloride also has a specific action, not yet well explained, which prevents the injurious action of certain toxins which might form in silage, at least in that of sugar beet pulp (ARLOING, 1883).

## PLANT DISEASES

### GENERAL INFORMATION

- 1171 - An Order of the Government of the Colony of Trinidad and Tobago Placing the Coconut Butterfly (*Brassolis sophorae*) Among the Plant Pests (1). — *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, No. 1, pp. 52-53. Port of Spain, 1918.

LEGISLATIVE  
AND  
ADMINISTRATIVE  
MEASURES

By the order No. 37 of 1918, given out on March 28, 1918, the coconut butterfly (*Brassolis sophorae*) is declared injurious to agriculture in the Colony of Trinidad and Tobago.

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

- 1172 - Myxomycetes and Fungi of the Province of Verona, Italy. — SACCARDO, P. A., in *Madonna Verona*, Year 1918, pp. 1-24 of the Reprint. Verona, 1918.

GENERAL

List of 3 Myxomycetes and 173 fungi identified by the author from material collected by Prof. C. MASSALONGO at various periods in the province of Verona, and to which were added some forms from the herbarium of the late A. MASSALONGO.

Five species and one variety of fungus are described as new to science.

Amongst the fungi quoted, many were observed on cultivated or useful plants.

- 1173 - Fungi from Singapore, Malacca and Campania (Italy). — SACCARDO, P. A., in the *Bollettino dell'Orto botanico della R. Università di Napoli*, Vol. IV, pp. 39-73. Naples, 1918.

I. — In 1917, Prof. C. F. BAKER collected a large number of fungi in the Botanical Garden of Singapore and sent them to the author for identification. The author found the material contained 90 species and varieties; of this number, 2 genera, 57 species and 8 varieties are given as new to science.

The following are worthy of special mention: —

- 1) *Aecidium Cassiae* Bresad., on leaves of *Cassia Tora*;
  - 2) *Meliola Mangiferae* Earle, on living leaves of *Mangifera indica*;
  - 3) *M. æthiops* Sacc. n. sp., on living leaves of *Cassia Fistula*;
  - 4) *M. mangostana* Sacc. n. sp., on leaves of *Garcinia Mangostana*;
  - 5) *Xylaria (Xyloglossa) tuberiformis* Berk., on *Hevea brasiliensis*;
- a doubtful species as the specimens examined were sterile;

6) *Xyl. (Xylogl.) obovata* Berk., at the base of trunks of *H. brasiliensis* ;

7) *Xyl. (Xylogl.) scopiformis* Mont. var. *heveana* Sacc. n. var., on trunks of *H. brasiliensis*.

II. — A list is given of 21 species and varieties new to science collected in the province of Avellino (Italy), save 2 from the province of Caserta (Nola) and Salerno (Scafati).

Nearly all the forms from the province of Avellino and from Nola were found on dead wood or branches of hazel (*Corylus Avellana*).

The author gives the name of *Cladosporium densum* n. sp. to the fungus found at Scafati on dead or dying stems of *Ricinus communis* and possibly injurious to the host-plant from the start.

RESISTANT  
PLANTS

1174 — Maize Resistant to *Ustilago Zeae* in the U. S. A. — See No 1999 of this Review.

MEANS  
OF PREVENTION  
AND CONTROL

1175 — Patents for the Control of Diseases and Pests of Plants. — See No 1155 of this Review

DISEASES  
OF VARIOUS  
CROPS

1176 — *Odontia Sacchari* n. sp. and *O. saccharicola* n. sp., Basidiomycetes Living on Sugar Cane, in Porto-Rico, Antilles. — BURT, E. A., in the *Annals of the Missouri Botanical Garden*, Vol. IV, No. 3, pp. 233-236 + 2 Figs. St. Louis, 1917.

Description of the following two new species of Hydnaceae collected in Porto Rico by Mr. J. A. STEVENSON :—

1) *Odontia Sacchari* Burt n. sp., on the dead basal part of leaf sheaths of the sugar cane and on remains of the same plant, at Río Piedras; other specimens had been collected previously at Santiago de las Vegas (Cuba).

2) *O. saccharicola* Burt n. sp., on living stems of *Saccharum officinarum* and also of *Paspalum*, at Río Piedras and Canovanas.

1177 — *Phyllosticta Rabiei*, a Deuteromycete the Specific Agent of "Rabbia" or Anthracnosis of the Chick Pea in Italy. — TROTTER, A., in the *Rivista di Patologia vegetale*, Year IX, No. 17, pp. 105-111; Pavia, 1918.

Towards the end of the spring of 1918 a small crop of *Cicer arictinum* L., grown for demonstration purposes at the farm of the Royal School of Viticulture and wine-making at Avellino, was suddenly attacked, a little before flowering, by a disease which, in a few days, killed a large number of plants and weakened or partly withered others. The disease was especially marked on the stems, where the spots, which were more or less elongated and peripheral, were accompanied by a necrosis which developed in depth with great rapidity, even causing the tissues to lose their turgidity and the stem its stiffness, so that many plants broke easily at the point of infection. The petiole and rachis were also affected and the corresponding leaves turned yellow rapidly and withered.

A microscopic examination showed the disease to be of a fungoid nature, and it was identified as "rabbia" or anthracnosis of the chick pea, recently described by many authors. It seem identical with the "rabbia del cece", reported for the first time under this name by F. R. (1807). The disease was attributed by COMES (1891) to the parasitical action of *Ascochyta*

*Pisi Lib.*, and this theory was accepted by many later plant pathologists. The author's recent investigations made on living material and dried material from different sources, show it, however, to be caused by a species of the related genus *Phyllosticta*.

In giving a specific name to the *Phyllosticta* of the chick pea it is impossible to call it *Phyll. cicerina* Prill. and Delacr. (1893) as another micro-mycete is already known by that name. It was this fungus which, as a result of an imperfect microscopical examination of the pycnidial tissues, PASSERINI (1867) wrongly considered to be a nectroideae and described under the name of *Zythia Rabiei* whereas there is no doubt that it is the *Phyllosticta* studied by the author. It, therefore, appears necessary to re-establish PASSERINI's species but to place it in the genus *Phyllosticta*, using *Phyll. cicerina* Prill. and Delacr., the description of which was accompanied by no critical or synonymous comment, as a synonym. In this case, with our present knowledge of "rabbia" of the chick pea, and from a point of view of practical systematisation, the fungus causing this disease can only be classed as a *Phyllosticta*, which should be known under the specific name of *Phyll. Rabiei* (Pass.) Trotter.

## WEEDS AND PARASITIC FLOWERING PLANTS.

1178 - The Control of *Imperata arundinacea* (Gramineae) by means of *Leucaena glauca* (Leguminosae) in the Philippines. — See No. 1123 of this Review.

1179 - The Control of Weeds in Ricefields. — See No. 1106 of this Review.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1180 - Notes on Some Aphides Collected in South Eastern Russia. — HAVILAND, M. D., in *The Entomologist's Monthly Magazine*, Vol. LIV (3rd Series, Vol. IV), No. 652 (45), pp. 200-202. London, September, 1918.

GENERAL

During the summer of 1917 the author collected several aphides on the steppes of south-eastern Russia. At the end of June and the beginning of July the collection was continued on the shore of the Black Sea, near Odessa; the author passed the rest of the summer at Reni, on the steppe near Galatz.

The species mentioned are:—

1) *Macrosiphum sonchi* Linn.; apterous specimens were taken on *Cichorium*, in August, at Bolgrad, Bessarabia, and on *Centaurea* in October at Odessa.

2) *Myzus cerasi* Fab.; not uncommon on wild cherry at Reni in July.

3) *Rhopalosiphum ribis* Linn.; at the end of June in a garden at Odessa shoots of a currant bush were found twisted by this species; one or two days later apterous specimens of *Rhop. lactucae* Kalt were seen.

4) *Aphis cardui* Linn. ( *A. myosotidis* Koch), on thistle at Odessa on June 30.

5) *A. laburni* Kalt; this species was very abundant at Odessa at the end of June and stunted and stunted young shoots of acacia, smearing them with honeydew: the winged form was just emerging at this time. The following week numerous newly-established colonies were found on *Melilotus officinalis* and alfalfa. Another aphid infesting a species of *Sambucus* in shrubberies and found also on *Chenopodium* near the sea, was found when examined comparatively, to be identical with *A. laburni*. This insect was preyed on by the larva of a coccinellid and by garden warblers (*Sylvia hortensis*). On a warm afternoon in October the author observed the invasion of a grove of acacias by the sea by a swarm of *A. laburni*, which was possibly a return migration of the sexual forms.

6) *A. myosotidis* Koch (= *A. cardui* Linn.); apterous specimens were taken on thistle at Odessa on June 29; they were severely parasitised by a small braconid.

7) *Aphis* sp.?; a few apterous specimens and one winged form were found clustered round the corolla of *Nigella* on the seashore near Odessa.

8) *Aphis* sp.?; apterous specimens infesting the common *Euphorbia* of the Bessarabian Steppe.

9) *Cryptosiphum artemisiae* Buckton; apterous specimens were found under the leaves of *Artemisia* in July.

10) *Dryobius croaticus* Koch; on shoots from the stump of an oak tree, in July; it was accompanied by numerous ants.

11) *Schizoneura ulmi* Linn.; common on elms in Odessa in June.

12) *Tetraneura ulmi* De Geer; the galls characteristic of this species were found on elms in Odessa in July, but all were then empty.

MEANS  
OF PREVENTION  
AND CONTROL

1181 — Aclimatisation Experiments in Italy with the African Hymenopteron *Opius concolor*, a Parasite of the "Olive Fly" (1). — SILVESTRI F., in the *Bollettino della Società nazionale degli olivicoltori*, Year XII, No. 1-2, pp. 1-3 of Reprint. Rome, 1918.

From the end of October, 1917, to the first ten days of March, 1918, were distributed in various olive orchards of Apulia (Fasano, in the province of Bari), of Latium (Hadrian's Villa, near Tivoli) of Campania (Cannichio, Pollica, Castelnuovo Vallo, Vallo della Lucania, and Ceraso, in the province of Salerno), and of Calabria (Sambiase and Nicastro, in the province of Catanzaro), 3 260 specimens of *Opius concolor* Szépl., an endophagous braconid parasite of the "olive fly" (*Dacus oleae* Gm.) found in September and October 1917, in Tripoli.

The majority of the insects were distributed at Hadrian's Villa (1 250) and at Ceraso (1 000), localities particularly suited to acclimatisation experiments. The author feels certain that it will be possible to acclimatise this *Opius*, at least in southern Italy and the islands, and hopes that it will destroy *D. Oleae* sufficiently to reduce the damage done by the dipteran in the olive orchards. This, however, cannot occur till the hymenopteron

(1) See R. Feb., 1911, No. 637; R. Feb., 1914, No. 190; R. Jan., 1917, No. 115, R. Feb., 1917, No. 210. (Ed.)

is really acclimatised and if it finds in its new surroundings no enemy to hinder its multiplication.

**1182 - *Pachymerus quadrimaculatus* a Weevil Injurious to the Black-Eye Pea (*Vigna catjang*) in Trinidad.** — URICH, F. W., in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Pt. 1, pp. 14-162 + Plates, Port-of-Spain, 1918.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

Apart from slight damage caused by damp the chief injury to stored black-eye peas (*Vigna catjang*) is through attacks of the black-eye pea weevil (*Pachymerus quadrimaculatus*). In Trinidad this insect infests generally black-eye peas and cow peas imported from the United States and Venezuela. Recently harvested peas appear most subject to attack.

This weevil is well known to the inhabitants of the island who are so accustomed to it that most of them affirm the peas cannot be kept free from it as it is generated by the peas themselves. No effort is, therefore, made to control it, and as soon as the harvest is gathered it is sold and re-sold as quickly as possible, as the peas will not keep for more than three months.

The damage is done by the larva, which eats the seed, and continuous generations feed on it till it is unfit even for the insects themselves to live on. A small chalcid, always associated with the weevil, preys on the larva. This natural enemy is well known to the inhabitants of Trinidad, who think it the young stage of the weevil. It controls *Pachym. quadrimaculatus* to some extent.

The black-eye weevil in peas can be destroyed by fumigations with carbon bisulphide (5 lb. to every 1000 cubic feet for 24 hours), and if the peas are kept in a clean, weevil proof room or receptacle they will be free from attack. As soon as possible after the harvest the peas should be dried and kept out of reach of the parasite. They should be examined before storing, and, if any eggs of the parasite are found, they should be fumigated and then aerated.

Peas for planting should be specially treated, and if fumigation is absolutely necessary, it should not last more than 12 hours.

Sprinkling the peas with kerosene oil and rubbing this oil in, as well as salting, cannot prevent attack by the weevil.

A description of the adult insect and short summary of its life history are given.

**1183 - *Phthorimaea operculella*, a Microlepidopteron Injurious to Potatoes, New for Indiana, U.S.** (1). — TROOR, J., in the *Thirtieth Annual Report of the Purdue University Agricultural Experiment Station, Lafayette, Indiana, for the Year Ending June 30, 1917*, p. 40. 1918.

During June, 1917, several loads of potatoes reached the Indianapolis market from Australia. These potatoes were badly infested with the potato tuber moth (*Phthorimaea operculella*), which has caused serious

(1) See R., Feb., 1912, No. 437; R., April, 1912, No. 749; R., July, 1912, No. 1117; R., June 1913, No. 751; R., Nov., 1914, No. 1081. (Ed.)

damage in California but has never previously been reported from Indiana. Growers were immediately notified as many of these potatoes had been planted before the infestation was discovered.

1184 - *Oxycarenus hyalinipennis*, a Hemipteron Injurious to Cotton, in Italian Somaliland (1). — DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, First Half-Year, No. 3, pp. 147-166 + 23 Figs. Florence, 1918.

Description of the life history of *Oxycarenus hyalinipennis* Costa, based on material from Italian Somaliland.

From the examination of the numerous cotton bolls received, it is quite certain that a great quantity of the eggs of the hemipteron are inside the bolls themselves, more or less close to the seeds on the surface of which they have been occasionally seen. The eggs are also laid on the bracts surrounding the bolls as well as at their base.

As the young *O. hyalinipennis* leaves the eggs laid in the bolls, they pierce the seeds to obtain food, as do all the following stages of the insects. Those larvae that hatch outside the bolls attack the basal walls and thus obtain nourishment.

As regards enemies of this hemipteron, in the absence of other insects, the author has found in the viscera of nymphal and adult *Oxycarenus* Sporozoa which he places provisionally with the Eimeridae and considers as new to science under the names of *Pissidocystia oxycarenidis* n. gen. and n. sp., and *Valvicystia rhopaloides* n. gen. and n. sp. At the same time the author observed coloured parasitic corpuscles in these Sporozoa which he suspects are Amaebosporidia.

1185 - *Nysius ericae*, the False Chinch Bug, Injurious to Sugar Beets and Cruciferous Garden Crops in the United States. — MILLIKIN, F. B., in the *Journal of Agricultural Research*, Vol. XIII, No. 11, pp. 571-578 + 1 Fig. + 2 Plates. Washington, June, 1918.

This paper gives a morpho-biological description of *Nysius ericae* Schilling (= *N. angustatus* Uhler), commonly known as the false chinch bug. This insect has long been recognised as a serious pest, especially in the semi-arid districts of the United States. It damages seriously sugar beets and cultivated cruciferae, settling upon them suddenly in enormous quantities and sucking so much sap that the plants wilt in one or two days.

The observations were made at Garden City, Kansas, from 1913 to 1916 and, during the last year, also at Wichita.

1186 - *Aleurocanthus woglumi*, a Hemipteron Injurious to Various Cultivated Plants, in Cuba (2). — CARDIN, P., in the *Revista de Agricultura, Comercio y Trabajo*, Year 1, Vol. 1, No. 3, pp. 128-130 + 2 Figs. Havana, 1918.

*Aleurocanthus woglumi* ("mosca prieta") threatens to become one of the greatest pests of Cuban agriculture. Oranges, lemons and other species of *Citrus* are attacked most commonly, being the first upon which

(1) See R., March 1913, No. 203; R., May, 1916, No. 590 (Ed.)

(2) See also R., Nov 1916, No. 1217; R., Dec. 1916, No. 1347; R. Aug. 1918, No. 933. (Ed.)



the hemipteron appears. From the great quantity of *A. woglumi* on the oranges of a given locality the intensity of the attack in that locality can be judged. The insect also attacks coffee, *Psidium Guajava*, *Mangifera indica* and an increasing number of other useful plants.

The author, using *A. woglumi* as an example, calls special attention to the necessity for limiting the trade in plants and controlling it in such a way that suitable officials can find out where newly imported plants are placed.

The history of the "mosca prieta" is a very typical case showing the results of free importation of and trade in plants. The insect in question, apparently a native of India, was introduced from that country with branches of *M. indica* into Jamaica, with the object of propagating choice varieties of that fruit tree by grafting. About 10 years ago, it seems to have appeared in the district of Guantánamo, introduced from Jamaica, on account of the great trade with that island and the region of Guantánamo and Santiago de Cuba.

While attempts were being made to control the insect in the region of Guantánamo, it appeared in November, 1916, in Vedado, probably brought on cuttings of the varieties of eastern *Mangifera* so much sought for in that country. Later it was reported from Hoyo Colorado, where it had been introduced with plants from Vedado. Already the pest has begun to spread in the neighbourhood of Havana, extending to Calabazar and Rancho Boyeros which is the south-eastern zone and where *Citrus* plants are most cultivated.

Owing to various causes the development of the hemipteron is limited:—dry weather and wind are the most efficacious, while heavy rains, ants in Guantánamo, a small spider and, according to recent observations, even *Chilocorus cacti*, are beneficial. In Jamaica the insect is attacked by a fungus—*Aschersonia*—and experiments are now in progress at the Agricultural Station of Santiago de las Vegas to utilise this control.

As artificial means of control soap emulsions and solutions are used; the best is that made of whale oil and potash soap, as it is so easily prepared.

## INJURIOUS VERTEBRATES.

1187 - *Bacterium murisepticum*, the Specific Agent of an Infectious Disease of Field Mice (*Pitymys savi*), in Apulia, Italy (1).—MORI, N., in *Atti del R. Istituto d'Incoraggiamento di Napoli*, Ser. VI, Vol. LXIX, pp. 7-16. Naples, 1918.

In the beginning of August, 1916, the author observed a serious and hitherto undescribed natural infection of field mice (*Pitymys savi*) from Ascoli Satriano, Foggia, where these rodents had greatly decreased in number.

A microscopical examination showed the presence in the blood of in-

(1) See R. April, 1917, No. 396. (Ed.)

fected mice of a bacterium, which the author isolated and considers to be the specific agent of the infectious disease observed. This bacterium has been identified as *Bacterium murisepticum* (Flügge) Mig., and the author describes its microscopical, cultural, biochemical and pathogenetic characteristics which have so far been studied.

In view of the value which this bacterium may have in the control of field mice, the author made experiments with it in fields infested with mice at Foggia, Torremaggiore and Pietra Montecorvino. Six or eight days after spreading on the soil small pieces of bread containing cultures of the bacteria or after spraying the plants round the mouse holes with broth of the cultures, a more rational and economical method, there was a marked decrease in mice in the places treated, followed by their complete disappearance. Sometimes the infection spread to untreated districts.

INTERNATIONAL INSTITUTE OF AGRICULTURE  
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LEGISLATIVE  
AND  
ADMINISTRATIVE  
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In order to encourage the cultivation of the castor-oil plant in Indo-China, the Governor General of the Colony issued a decree dated February 16, 1918, regulating the issue of advances to castor-oil plant growers for the duration of hostilities.

By this decree the advances may be issued in the form of seed or loans. The borrower must undertake to sell to the Supply Service the whole castor-oil crop grown on his land for the cultivation of which the advance was made. The Administration ascertains that the sums advanced are devoted exclusively to the cultivation of the castor-oil plant and verifies the condition of the crops. Supervision may continue until the grower has discharged his whole debt. A maximum is fixed for the advances made for acreage already in condition to be cultivated, and another higher one for land which has to be prepared.

1189 — Measures Taken by the Administration in Indo-China to Promote the Development of Sericulture. — See No. 1264 of this *Review*.

1190 — Native Agriculture in Cochinchina. — QUESNEL, P., in *Congrès d'Agriculture coloniale, Gouvernement général de l'Indochine*, Saigon Series, *Bulletin* No. 1, 46 pp. + 1 Plate. Saigon, 1918.

DEVELOPMENT  
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The Author (Civil Service Administrator and Inspector of Political and Administrative Affairs) draws attention to the fact that Cochinchina is a purely agricultural country with, it may be said, one crop — rice. Of

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the 20 provinces of the colony, only 5, situated in the East (Basia, Bienhoa, Thudaumot, Tayniuls and Giadinh), are provinces in which rice can only be grown in the valleys; the rest of the land, more or less high, is covered with forests or bare plains on which stock find a scanty pasture. In these provinces, in either grey or red soil, are found the rubber plantations and it should be possible to grow other crops there as well.

In the 15 other provinces situated in the Delta of the Mekong, Vaïco or the Saigon River, rice is practically the sole crop. The natives only grow other products as secondary crops, on land sufficiently high to be free from floods, on the banks of the canals and the "giongs", large banks of sand formed by the sea. Coconut and betelnut are cultivated along the waterways, where the houses generally are, but only on a small scale.

Of a maximum of 3 500 000 inhabitants there are 240 000 Cambodians, 153 000 Chinese, 31 000 Mois (savages), 6 800 Malays, and 71 000 Minh-huongs (half-breeds of native and Chinese parentage). There are some hundred foreigners — Indians, Japanese, Burmese, Arabs, Bengalese. Of the 153 000 Chinese living in Cochin-China, 22 000 are at Saigon and 75 000 at Cholon-ville. There are 35 000 Annamites at Saigon and 38 000 at Cholon-ville. If the Minh-huongs are reckoned in with the Annamites there are 2 975 000 Annamites and 431 000 other Asiatics. This only makes 3  $\frac{1}{2}$  million, but it must be remembered that many natives, like the Chinese, live without being registered anywhere so as to avoid paying taxes and, for this and similar reasons, the statistics supplied by the villages are always below the actual ones.

The author studies briefly these different classes of the population and shows that, without considering the Chinese, who are foreigners, the Annamite adapts himself best to our civilisation and our cultivation, that the Moï, although a savage, would also adapt himself well were it possible to get into closer touch with him, and that it is the Cambodian whom it is most difficult to touch, chiefly because of his purely buddhist education. The author then studies the development of the question under two main headings: — 1) agriculture properly speaking; 2) labour.

## I. AGRICULTURE PROPERLY SPEAKING.

*Present state of agriculture in Indo-China.* — The principal crop of Cochin-China is rice of which numerous varieties are cultivated according to the soil, its composition, position, and the quantity and the nature of the waters it receives during the rainy season. The area under rice increases each year because there is still much available uncultivated land in certain parts of the colony. As a rule this land is unfit for cultivation and valueless as a result of the stagnation of the water which often causes an excess of alum. Where, however, the Administration builds a canal, this land gradually becomes of value, the excess of injurious alum being carried into the canals by the surface waters (rain, floods). In a general way it may be said that the clay soil of Cochin-China contains alum to a

more or less marked extent ; it occurs everywhere, in the low South-West regions and in the high forest districts of the eastern provinces. .

With the exception of the eastern provinces, it may be said that all Cochin-China is one vast rice field, already planted or about to be so. Rain falls pretty regularly each year from May or June to October or November. It is usually early in the East and becomes later as the Gulf of Siam is approached, so that the harvest is earlier in the East and allows a large part of the population to go for the harvest to the western provinces, where labour is generally insufficient on the large estates.

In September or October, at the time of transplanting, the floods come in addition to the rain. The muddy waters of the Mekong spread more or less rapidly over that part of Cochin-China which borders on Cambodia. In the rest of the country, which is lower, the tides penetrate inland, bringing with them fertile mud.

The harvest is generally sure in Cochin-China ; it is sometimes more, sometimes less fine, even average, but there is no danger of famine. As rice forms the basis of the diet of the natives, Cochin-China largely supplies the food requirements of its population. In certain provinces (Chaudoc, Longxuyen) maize-growing has been started and tends to develop because the grain ripens and may be cut in three months, just as the first rains are beginning. It may, therefore, be grown in many rice fields near water-courses, so that it may be easily watered, and the same land may yield two crops of about equal value.

In 1915-16 Cochin-China produced 2 188 000 metric tons of paddy, in 1916-17, 2 350 000 tons. About 1 100 000 tons are kept back for local consumption and seed, the remainder is exported. Each year the harvest improves as a result of improved cultivation.

*Agricultural products exported at the present time.* — A table is given of the exports in 1914, 1915, 1916 and 1917. These products are :— rice (export about 922 259 metric tons in 1914 and 449 565 metric tons in 1917), paddy (approx. 41 482 metric tons in 1914 and 3 986 tons in 1917), cargo (approx. 25 181 metric tons in 1914 and 49 803 tons in 1917), rice bran (approx. 146 608 metric tons in 1914 and 72 605 in 1917), meals (approx. 159 944 metric tons in 1914 and 59 872 in 1917), maize (approx. 30 938 metric tons in 1914 and 7 485 in 1917), kidney beans (13 860 lb. in 1914 and 37 770 lb. in 1917), other dry leguminous seeds pepper, cattle (650 metric tons in 1914 and 100 in 1917), poultry, copra, peanuts, sesame and other oil-yielding seeds, fresh coconut, coconut oil, rubber (401 060 lb. in 1914 and 885 122 lb. in 1917), wood charcoal, kapok, various cakes, silks, silk wastes, ox hides, pig bristles, feathers, eggs (679 327 lb. in 1917), honey, feathers for fans, lard, castor oil.

*Labour devoted to cultivation.* — The different methods of farming, varying in each province, the different systems adopted by large land-owners to keep the workmen on their estates, to pay them, to advance them money and grain, are all reviewed. The expenses are fairly heavy as compared with the yield, but nevertheless the growing of rice by the present day methods yields a good profit. Many of the natives live well and give

an impression of ease and comfort very different from the poverty found among the natives of Tonkin and Annam.

*Yields per acre.* — **RICE.** — The yield varies from 80 to 100 *gia* for the average ricefields, or, 14.6 cwt. to 18.3 cwt (1 *gia* = 50.6 lb.) In certain soils it is as much as 120 or 150 *gia* (22 to 27.5 cwt.) and in poor soil, especially in the eastern provinces, may be as low as 20, 30, or 50 *gia* (3.7, 5.5 or 9.2 cwt.).

**MAIZE.** — Yields a profit in the province of Chaudoc about equal to that of rice.

**TOBACCO.** — This crop is being developed. It is grown mainly in certain parts of the east. The tobacco has a peculiar flavour and, for that reason, is only used by the natives and is consumed entirely in the country. The province of Giadinh yields the two best qualities of tobacco: — 1) Govap tobacco, the most appreciated by the natives, 2) Hocmon tobacco. One acre yields approximately 1943 cakes of govap tobacco weighing 300 gm. each, or 9.6 cwt.; the sale price is \$ 35 (1) per 100 cakes or \$ 680 with a profit per acre of \$ 85. One acre yields about 1217 cakes of Hocmon tobacco, weighing about 8.3 cwt. and selling at \$ 29 per 100 cakes, or \$ 400, the profit per acre being \$ 72.

**SUGAR CANE.** — Sugar cane is grown over about 11 000 acres in the eastern provinces. The species most widely grown for sugar production in this district are yellow cane, called "mia-vang", planted in low, rich soils, red cane, called "mia-ly", grown in rich, moist soils, and small cane, called "mia-lau", grown in high, dry soils; "mia-vang" yields 17.5 tons per acre and sells at \$ 265; "mia-ly" yields 11.5 tons per acre and sells at \$ 226; "mia-lau" yields 9.5 tons per acre and sells at \$ 111; the cultivation of this last variety is decreasing.

**PEANUTS.** — 30 to 32 *gia* per acre. Green peanuts weigh 26 to 33 lb. per *gia* and dried ones 22 to 24 lb. The sale price is approximately \$ 0.60 to \$ 0.65 =  $0.65 \times 30 =$  \$ 19.50 (for 30 *gia*) per acre.

**SWEET POTATOES.** — 20 *gia* of 48 to 50 lb. on an average; \$ 0.80 approximately, or \$ 16.

**MANIOC.** — Approximately 6.7 tons per acre. Sale price \$ 1.90 per *picul* of 132 lb. or \$ 217 per acre (a net profit of \$ 121).

*Possible improvements.* — The ploughs seem suitable to the nature of the land. Cochín-China rice is at least equal in food value to the best varieties of Japan, Java or Burma, but is less fine. It is, therefore, necessary:—

1) That the natives harvest so as to avoid any moistening of the sheaves because the rice often ripens before the soil of the field is quite dry. The sheaves are laid on the ground in small heaps so that the upper ones do not come in contact with the water, but the lower ones become wet and the grain spoils.

2) That the crop, which is usually threshed in the field, be brought in so as not to be wetted by late rains.

(1) 1 Indo-Chinese silver piastre (\$) = 2s. 3d. at par. (Ed.)



3) That the natives be provided with sorters so that they may set the finest grain apart *a*) for sowing, *b*) for selling, keeping the remainder for local consumption. In this way the natives would be able to select the grain easily and rapidly and supply better qualities with a higher yield.

According to the native nomenclature there are numerous varieties of paddy which, with the exception of the round grain and long grain varieties, are very difficult to differentiate. They are similar rices which have become slightly modified according to the nature of the soil in which they are grown. Sorting the grain would reduce these numerous varieties to a small number, taking into consideration the species with round or long grain, early rice and mid-season rice, and the nature of the fields, high or low, swampy or not. The swamp and semi-swamp rices of Chaudoc and Longxuyen form a very interesting distinct variety, the cultivation of which has been greatly improved by the natives who have produced swamp rices with practically none of the red grain which detracts so largely from their value. Good, inexpensive sorters should, therefore, be supplied. If selection of the good grain were combined with the rooting up of foreign varieties the quality of the grain would be rapidly improved.

4) The natives cut the rice sheaves by hand with a sickle at mid-height. A large quantity of stubble is thus left. Animals are first pastured in the field, but when they will not eat the straw because it is too dry advantage is taken of the strong winds of the dry season to burn it. The ashes obtained are of small advantage to the soil, especially as the wind carries many of them far. It would appear more advantageous not to burn the culms but to plough them in. They would decompose rapidly in the water-soaked soil and the roots of the new plants would derive benefit from them.

5) Fertilisers have been recommended to improve the yield, but the question is very complicated. The natives are poor and, generally, have few savings, living from hand to mouth, so that any fertiliser supplied must be cheap. The yield of the Cochin-China rice field is low when compared with those of Java. Cultivation is extensive because free land is not lacking and will not lack for a long time. More than double the quantity necessary for local consumption is produced. If it were possible to obtain a cheap fertiliser it is not certain that the benefit obtained would pay the expenses. In Cochin-China, where the Mekong River is not dammed, as is the Red River, in Tonkin, the whole country is flooded naturally in September and October. The waters, charged with fertilising mud, spread over the whole country, and the natives, by a very simple system of gutter-stones and gaps in the banks of the rice fields, make the waters penetrate far inland. The rice plants act like innumerable sieves and filter the muddy water, which, losing the rapidity of its current, deposits the mud on the soil. Fertilisers spread on these fields full of water would dissolve very rapidly and be largely carried away by the waters in the canals and ditches, or each field would have to be well shut in and would no longer benefit by the floods and the movement of the fertilising waters. Would there be any appreciable advantage to the

natives, for whom nature works, for the floods are rarely heavy enough or sufficiently prolonged to damage the crop. The natives profit more than they suffer.

6) It also appears premature to use machines for cultivation. The natives have adapted their tools to the soil and the nature of the plant they cultivate. European machines are too heavy to use in a soil which only dries and hardens when nature allows it to do so. The natives use a hoe, plough and wooden roller. The rice is generally threshed in the field in large wide-mouthed baskets about 6 ½ feet high, made of bamboo laths plugged with earth. As the grain drops easily, the sheaf is beaten on a sloping bench placed inside the basket; the grain drops to the bottom and is collected in baskets. To carry the rice sheaves to the farm a sledge drawn by oxen or buffaloes is used. This sledge passes everywhere, making gaps in the embankments of the rice fields. This material is simple, easily made and repaired, and adequate.

The only improvement required at present is that the Annamites should select their seed so as to prevent degeneration of the plant and decrease in yield. For this purpose they should be supplied with good, cheap sorters.

Each year Cochin-China receives from Cambodia, Laos and South Annam live stock to replace that which has died or to meet the requirements of the increased population. The demand has become yet greater since the formation of large rubber plantations which often require large herds for ploughing or fertilising purposes.

*Breeding.* — Cochin-China is not a breeding country and probably never will be on account of the floods in the west and the short grass produced by the poor, dry soils of the East during the dry season.

*Factors favourable to the development of native agriculture.* — Agriculture has hardly made any progress in the colony, it has developed in acreage only, not in yield, but in this sense has developed considerably. This is due to the reclaiming of immense uncultivated plains by digging canals with dredgers. Colonisation by Europeans has also increased.

Agriculture will develop more and more if numerous roads and canals are built. The regulation of labour (decrees of March 8, 1910 and May 20, 1913), largely imported from Annam or Tonkin, less from Java, has facilitated the establishment of rubber plantations in the East. The decree of April 13, 1909 concerning native workers on farms has been of more use to the French colonists of the West. The granting of land under special conditions with certain advantages has favoured both native and European colonisation.

Native agriculture (special reference is made to rice, all the other crops being secondary as compared to it) is developing normally under the effects of several causes :—

1) Some administrative :— digging numerous canals with dredgers, good maintenance and improvement of the natural and artificial transport ways already existing, etc. ; the greatest attention is being given to this.

2) The other natural :— the increase of the population which now

numbers approximately 3 500 000 and increases by about 100 000 annually.

## II. LABOUR.

As the rule the natives are both farmers and fishers ; in the wooded districts they are also foresters. Only the Moï is a woodman in particular and cultivates barely enough for his requirements.

Up to the present the labour question for the crops of Europeans has not become acute. In the western rice fields the decree of April 13, 1909 concerning agricultural labourers makes it easy for the colonists to obtain labour. In the rubber plantations of the East the decrees of March 8, 1910 and May 20, 1913 regulate the connections of the planters with the numerous workmen they are bound to employ, mostly in distant and unhealthy districts. They not only deal with foreign labour, but also with Indo-Chinese labour. Some people have brought over Javanese, most bring men from Annam or Tonkin, the latter being acknowledged to be better than those from Annam. By employing also the natives and, in some districts the Moïs, the planters have been able to obtain the necessary labour.

The two decrees are to be fused into one decree more suited to the present requirements. This modification has been found necessary as a result of certain difficulties which arise from time to time in some plantations. It will provide for an inspection of labour which will probably be entrusted to the Inspector of Political and Administrative affairs. It also provides for fixed salaries, the form of work, assistance and care in the case of sickness, boarding, feeding, water-supply, etc. On the whole the planters (less in the West, because it is healthy) have done their best for the comfort of their workmen. Rewards are given to good and old labourers, houses of a more or less permanent character of clay or bricks roofed with tiles have been built for them and their families. Drinking water is supplied, there are ambulances and hospitals, markets have been formed so that they may supply themselves without difficulty, even amusements are supplied at certain times of the year on the occasion of their religious festivals, theatrical companies, and cinemas.

There as elsewhere if the natives are comfortable they ask nothing better than to remain and be re-engaged. The labour on a plantation represents a large capital and the better it is, in better condition is the plantation and, consequently, more productive. It is in the interest of conscientious planters to look after their workmen and treat them well. On the large western agricultural estates the labour changes but little as a rule ; the conditions remaining the same the workman show no desire to go, and remain on the estate. Only those go who are badly treated or who, by nature, are fond of change and cannot settle in one place.

There is, however, no doubt that the labour in the country is inadequate to the development of the plantations in the East ; imported labour will be needed more and more. If the development in the East continues as

at present great attention will have to be given to the importation of labour or it will become a real danger to the agricultural settlement of the West, where labour is already insufficient. The importation of labour must be facilitated but, in the author's opinion, only labour from Indo-China, Tonkin and Annam should be used. Any kind of work may be entrusted to the Annamite if he is correctly approached. He is a product of an old civilisation which has developed without interruption and there is no doubt that he is destined to colonise all Indo-China.

**1191 — Foods of Tonkin.** — CHEVAST, C., in *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Hanoi Series, No. 2, 17 pp. Hanoi-Haiphong, 1918.

In these notes which form a complement of the "*Catalogue des Produits de l'Indochine*, Vol 1, *Produit alimentaires*", the author (Inspector of the Agricultural Services, Keeper of the Agricultural and Commercial Museum) reports the foods peculiar to Tonkin which are suitable for consumption in France.

**I. — VEGETABLE FOODS — Rice.** — Tonkin can export an average of 200 000 metric tons of rice and paddy. Of this quantity the Tonkin rice-fields at Haiphong can supply 9 to 15 000 tons of polished (table) rice. The annual production could reach 30 to 35 000 metric tons.

**Maize.** — In 1913, Tonkin exported 53 000 metric tons, in 1915 only 23 454 tons, and in 1916 5500 tons. The decreased exportation is due to the rapidly increasing local consumption.

**Kidney beans.** — Their cultivation will be intensified in Tonkin.

**"Mungo peas".** — The small French bean has proved suitable as a food in Europe cooked as other beans and prepared as "purée" so as to remove its outer coat; it has a vegetable taste peculiar to itself. Tonkin could supply nearly 500 metric tons of these beans annually, the other countries of Indo-China about 700 tons together at an average price of 6 to 7 *piastres* per 100 kg. (220 lb.).

**Various dolichos.** — Little liked in Europe because of their unpleasant vegetable taste, but perhaps suitable for livestock. In Tonkin alone an annual production of 1000 metric tons at \$4.50 to \$5 per 100 kg. may be relied on.

**Soya.** — The annual yield in Tonkin is approximately 1 000 metric tons selling at \$8 to \$9 the 100 kg.

**Cereals.** — In the Yunnan district where the climate is temperate, the author has as yet been unable to determine the amounts available or their value.

**Manioc (slices).** — There are two species in Tonkin, sweet manioc and bitter manioc, both largely cultivated. In normal times the dried slices are sent to France. About 100 metric tons of slices are available annually at an average price of 4 *piastres* per 100 kg.

**Manioc paste ("Ho-Tieu").** — A product made in Annam; 14 *piastres* per 100 kg.

**Bean vermicelli ("Song-Thân").** — In Annam 176 000 lb. per year are made. This product is distributed by Chinese buyers at Singapore, Hong-

Kong, Bang-Kok. It is an excellent dietetic food which could be used especially in hospitals.

*Flours.* — Tonkin has no large flour factory. The by-products of decortication (factory flours) are only usable as mash for animals. In Cochinchina the average amount of the exportation of these flours from rice factories is 128 000 metric tons.

*Arrowroot starch.* — In Tonkin this is prepared from two plants — *Maranta arundinacea* ("Koang-Tinh") and *Costus speciosus*. Both these plants are being grown to an ever-increasing extent in the Delta and in certain provinces of Tonkin. The starch yield of the roots is 24 %. Arrowroot starch is very suitable as a food for infants and convalescents. The price is about \$ 0.30 per kg. of starch.

*Sweet potato starch.* — The "Khoai-Lang" sweet potato with its 5 or 6 local varieties is much grown in Tonkin. The starch yield of the tubers is 15 %, the selling price \$0.30 per kg. of starch.

*Sweet potato slices.* — A local industry. These slices appear to yield 34 to 40 % of their weight in alcohol.

*Yam (Dioscorea) starch.* — Five or six species of yam are grown in Tonkin. The starch is very nutritious. There are no fixed prices.

*Taros (Colocasia).* — There are several species in Tonkin. The average price of the roots is \$0.40 a load of about 55 lb.

*Annam and Tonkin spathe.* — The Annam species "Khoai-Nua" is represented by *Amorphophallus campanulatus*. Tonkin spathe ("Khoai-Na"), *Amorphophallus Rivieri*, is much used as a food for pigs.

*Tacca.* — The plant ("Nua") is not cultivated in Tonkin, but in Central Annam occurs frequently enough to be taken into consideration. It yields as much as 30 to 33 % of food starch.

*Bulb dolichos.* — The tubers cost from \$0.80 to \$1 a load.

*Kondzou.* — The tubers are made into starch.

*Sago.* — In the high districts of Tonkin the mountaineers obtain the pith of certain palms such as "Cây-Dao" (*Phoenix farinifera*) and "Cây Moc" (*Caryota*). The manufacture is limited to the very small demand. The product should be sought in south Indo-China where *Metroxylum*, which produce good sago, is fairly common.

*Vegetables: Bamboo shoots* ("Mang-Tre-Khê"), \$0.32, \$0.30 and \$0.25 a pound of 600 gm. according to the three qualities.

*Dried mushrooms:* "Mộc-nhi" and "Nâm-huong".

*Coffee.* — Small production.

*Tea.* — The European colonies of Tonkin and Annam can supply an average of 500 metric tons of prepared tea.

*Sugar.* — Tonkin is still dependent on Annam.

*Dried spices.* — \$0.50 to \$0.60 the kg.

*Camellia oil.* — Tonkin and North Annam can produce about 10 000 kg. annually. The seeds sell at \$5 to \$6 the 100 kg., the oil at \$24 the 100 kg.

*Peanut oil.* — Tonkin produces few peanuts; south Indo-China pro-

duces far more. The average exports from Indo-China from 1910 to 1916 inclusive were 368 000 kg. of seed and 104 000 kg. of oil.

*Sesame oil.* — Sesame is well cultivated in Tonkin but yields little oil there (about 3 000 kg. were exported to China in 1914). In the rest of Indo-China the production is much greater. In Tonkin the seeds sell at \$13 per 100 kg. and the oil at \$20 to \$22 to 100 kg.

*Coco-oil.* — Coconut is rarely cultivated in Tonkin.

II. — ANIMAL PRODUCTS. — *Cattle.* — Tonkin receives 20 000 head of cattle annually from North-Annam and from 4000 to 5000 head from the Chinese province of Quang-si. A fairly large cold store has recently been erected at Bê-n-Thuy, near Vinh (Annam) for dealing with frozen meat supplied from the livestock of North Annam and the neighbouring provinces of Laos.

*Pigs.* — As a result of floods the stock of pigs in Tonkin has decreased markedly; this accounts for the appreciable rise from \$0.32 to \$0.45 of pork on the Hanoi market. Nevertheless the breeding of young pigs for market is actively carried on in the mountains and, if the floods do not interfere again, it will not be long before the country is stocked normally. It is estimated that there are over a million pigs in Tonkin which is better stocked in this respect than any other country of Indo-China. The annual consumption of the town of Hanoi may be placed at 32 000 head. Estimating the total consumption of Tonkin to be 400 000 head, it should be possible to export a considerable amount of pork to France.

*Pig's fat; lard.* — The maximum quantity Tonkin can produce is 15 400 lb. of lard per month.

III. — SEA PRODUCTS. — *Dried and salt fish.* — In 1914, 1 337 600 lb. of such fish was exported from Tonkin to China. In a good year the sea catch of Tonkin gives a figure to which must be added from 100 to 120 metric tons of various products (holothuria, sharks' fins, etc.).

*Dried shrimps.* — A very substantial food; 26 400 lb. are exported to China annually.

*Fish and shrimp pastes.* — These pastes could not replace the very expensive cod's roe, obtained from Norway, but could at least be mixed with it. As much as 308 000 lb. (the export to China in 1910) may be produced annually.

*Prepared holothuria.* — Indo-China produces fairly large quantities; each year Tonkin exports about 50 metric tons to China. They sell at \$15 to \$20 the *picul* of 60 kg. (132 lb.).

*Nuoc-mam.* — A fish food made in three qualities selling at \$2.5, \$2 and \$1.50 per petroleum tin (about 39 lb.)

1192 — *Contribution to the Study of the Culicidae of French Guiana.* — LEGER, M. (Institute of Hygiene of Cayenne), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 5, pp. 397-400. Paris, 1918.

Diseases transmitted by Culicidae are of the greatest pathological importance in French Guiana and have often proved serious obstacles to colonisation; malaria, filariasis and yellow fever hindered the economic

development of the country in the 19th century. The species of Anophelidae and Culicidae and their distribution throughout the colony are given. Only two species of Anophelidae are known — *Anopheles (Cellia) argyrotarsis* Desv. and *A. (C). albimanus* Wied. (*cubensis* Agr., *albipes* Theob.); the second species is the more common.

The *Culicidae* identified by the author at the Institute of Hygiene of Cayenne are : — *Culex fatigans*, *C. digitatus*, *C. mathisi*, *C. flavipes*, *Culicella taeniorhynchus*, *Taeniorhynchus fasciolatus*, *Mansonia amazonensis*, *Melanoconion atrotum*, *Stegomyia fasciata*, and *S. luciensis*, a variety of the preceding one.

1193 — The Tatu (*Tatusia novemcincta*), Host of *Schizotrypanum cruzi* the Agent of "Minas Meningitis", in Brazil. — *Chacaras e Quantas*, Vol. XVII, No. 6, p. 450. São Paulo, June, 1918.

In 1912, at Lassance, Minas, Dr. CARLOS CHAGAS, director of the " Instituto Osvaldo Cruz " at Manguinhos, Minas-Geraes, Brazil, discovered that this armadillo or tatu (*Tatusia novemcincta*) is the primary host of the protozoan known as CHAGAS' protozoan (*Schizotrypanum cruzi*) which, when inoculated into man by *Triatoma (Lamius) megistus*, a sucking insect of the *Reduviidae* family, causes the very serious disease known in Brazil as " Minas meningitis " and " babeiro ". The acute form of this disease causes nervous trouble or meningitis (this especially in children), and its chronic form causes changes in the thyroid gland and cretinism.

The protozoan causes no disease in the tatu. When the insect, also known as " barbeiro ", sucks the blood of an infected tatu *Schizotrypanum cruzi* develops in its intestinal tube, and passes through to the salivary glands. When the insect bites man it inoculates him with the parasite.

" Minas meningitis " occurs only where tatus live. The carrier insect *Triatoma megistus*, has been found both in human dwellings (especially huts) and the holes of tatus. If these animals were destroyed the contagious illness would disappear. Furthermore, an enemy of poultry yards would also be suppressed.

1194 — I. Vitamines and Symbionts (1). — II. The Action of Symbionts on the Constituents of Fats. — BERRY, H. and PORTIER, P., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, I, No. 23, pp. 963-966. Paris, June 10, 1918; II, No. 25, pp. 1055-1057. Paris, June 24, 1918.

I. — After referring to the indispensability of vitamines in feeding, the authors give the results of the researches they carried out to ascertain if there is any relation between vitamines and symbionts (bacteria isolated from the tissues of normal animals).

A first series of researches showed that symbionts introduced into the vertebrate organism were perfectly tolerated, and caused no disorder or suppuration, and seemed to disappear rapidly from the circulatory system, tissues or serous membranes.

As these microorganisms were shown to be harmless, their possible intervention in the phenomena of metabolism remained to be proved.

(1) See R., October 1917, No. 926. (Ed.)

Young, but nearly full-grown, white rats were used as experimental subjects, then adult rats and finally pigeons. The rations given the subjects were such as would cause disorders of sub-nutrition after a certain length of time (seeds decorticated or sterilised at high temperatures for the pigeons; bacon or bacon fat sterilised at high temperatures, coagulated white of egg, salts and water for the rats). Controls received a ration composed of the same foods, but such as would not cause metabolic disorders (seeds with the seed-coats, unsterilised bacon or fat).

RESULTS. — 1) The experiments all confirm the chief results obtained by EYKMAN, GRYNs, FUNK, etc.:— loss of appetite, emaciation, locomotor troubles, paralytic phenomena, etc. A prolongation of the experiment led to death preceded by a very intense adynamic state and trophic disturbances in the rats.

When the animal suffering from nutritive deficiency (cared) was given a normal diet it continued to lose weight for a few days, but, under the influence of the vitamins in the food, the morbid symptoms gradually gave way and it recovered.

2) A cared animal, already intensely affected with the pathological phenomena already described, is taken and injected under the skin or in the peritoneum with a culture of living symbionts. After 24 to 48 hours, an extremely striking change takes place. The locomotory troubles vanish very rapidly; the animal soon recovers its agility and has a remarkable appetite, especially for fats; the loss of weight ceases, being replaced by a clear gain of weight.

These phenomena are still more striking with pigeons, which pass in a few hours from a complete adynamic state to an almost normal appearance in both walking and flying.

Repeated injections (always of 1 cc.) of the living cultures produce the same good results each time.

Thus the introduction into the organism of symbionts of appropriate origin and in suitable form, eliminates the nutritive deficiencies due to a diet lacking vitamins. The initial hypothesis was thus clearly verified by repeated experiments extending over several months.

The only objection that can be raised appears to be that the microorganisms injected act, as far as they are living, by the vitamins they contain and that any harmless bacterium could produce the same good effects.

It certainly seems that certain microorganisms (yeasts) contain vitamins but it should be noted that intestinal bacteria apparently do not contain vitamins since in nutritive-deficiency experiments disorders appear in spite of the abundance and variety of the intestinal flora. It seems remarkable that symbionts, normal inhabitants of the organism, can play the part of vitamins.

II. — The authors wish to show that symbionts can reproduce certain normal phenomena of animal metabolism, especially as regards the constituents of the fats.

Glycerine, which appears to be a source of sugar for the organism, is changed into dioxyacetone (triose [C<sub>3</sub>] sugar which easily changes to



hexose). On the other hand it can be probably shown experimentally that salts of  $\alpha$ -glycerophosphoric acid can be changed into salts of dioxy-acetone phosphoric acid in the same way.

Symbiotes can also carry out, *in vitro*, the  $\beta$ -oxidation that applies to fats of low molecular weight. On inoculating a sterile, neutral broth containing 1 % of  $\beta$ -oxybutyric acid, proteins and nitrates with these bacteria, the presence of acetone and acetic aldehyde may be detected after 3 weeks. Starting from butyric acid and using a similar medium to that described, the authors found acetone present in the culture solution; the other substances were not sought for. The presence of acetone shows the production, at a given moment, of the corresponding  $\beta$ -ketonic acid and that of acetic aldehyde shows that the fat molecule has been greatly broken down.

This is the first example, so it appears, of the carrying-out of the physiological process in question by means of microorganisms.

**1195 - Studies on Nitrogen Poisoning.** — Maignon, F., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 22, pp. 919-922; No. 24, pp. 1008-1011; Vol. CLXVII, No. 2, pp. 91-94. Paris, June 3 and 17, July 8, 1918.

I. — INVESTIGATIONS INTO THE TOXICITY OF EGG ALBUMIN; INFLUENCE OF THE SEASONS ON THE SENSIBILITY TO NITROGEN POISONING. — MAGENDIE showed in 1816 that nitrogenous foods are indispensable to animal life; he also concluded they are insufficient in themselves as dogs fed on pure gelatine died from emaciation.

The author continued MAGENDIE's experiments and fed white rats on true albuminoid matter (egg albumin, fibrin, casein) of the highest possible purity. Commercial finely powdered egg albumin was made up into pills weighing 1 gram by the use of a weak solution of gelatine. To avoid demineralisation of the experimental subjects small quantities of mineral salts and bicarbonate of soda were added to the pills so as to keep the urine slightly alkaline and to prevent acidosis. The experiments led to the following conclusions:—

1) Egg albumin is incapable of supporting life and maintaining weight in the white rat;

2) White rats fed on egg albumin die rapidly of acute poisoning of the central nervous system in May and October, but succumb slowly from emaciation in August and January.

These facts make it possible to understand the seasonal character of the manifestations of certain nutrition diseases connected with nitrogen poisoning; such as eczema, rheumatic troubles, etc.

3) Acute albumin poisoning causes coma.

II. — A COMPARATIVE STUDY OF THE TOXICITY AND THE NUTRITIVE POWER OF FOOD PROTEINS EMPLOYED IN THE PURE STATE. — The investigations, similar to the preceding ones and also made on white rats, dealt with fibrin, casein and meat powder, this last substance being previously extracted with boiling water, alcohol, and ether. In spite of this treatment the powder still contained an appreciable quantity of fat in the form

of adipo-protein compounds. These proteins were given at discretion in 1 gm. pills to which had been added, as in the previous case, mineral salts and bicarbonate of soda to avoid de-mineralisation and acidosis.

The experiments showed that none of the proteins tested are capable alone of supporting life and maintaining weight in the white rat, even for short periods. The influence of seasons, so marked for egg albumin, is entirely lacking for the other proteins. The toxicity can only be estimated by the length of time the animal survives. From this point of view the proteins under consideration can be classed in the following order for the white rat :— egg albumin, fibrin, casein, the latter being by far the least toxic. Meat powder may be placed on a level with fibrin.

With fibrin, casein and meat powder death, in every season, is the result of exhaustion of the reserves, not of chronic poisoning. The animals die from atrophy after heavy losses in weight. The lesions caused by food poisoning are insufficient to account for death. Rats fed with casein or fibrin have, after some time, a very fatty liver, which may be recognised by its yellowish colour and thick, rounded edges. The microscope shows the presence of excessive internal fat. In the case of casein the excess is double that caused by fibrin. It is not present with egg albumin and meat powder. The length of time the animal survives and the facility with which the albumins ingested change to fat are closely related. Everything points to the fact that the fat formed prolongs the period the animal survives by decreasing the rapidity with which the reserves are exhausted, the death occurring only when the reserves of fat have practically disappeared, as if this substance were indispensable to the utilisation of the proteins ingested. As the influence of the seasons does not exist with casein and fibrin, it seems as if the presence of fat makes the organism less sensitive to nitrogenous poisons in spring and autumn.

III. — INFLUENCE OF THE SPECIES OF ANIMAL ON THE TOXICITY AND UTILISATION OF FOOD PROTEINS. — After having studied the poisonousness and nutritive value of food proteins, using the cat and dog as subjects, the author compares the results obtained with the two species, using egg albumin, casein and meat powder.

1) With *egg albumin*, a fixed weight is never maintained in either cat or dog.

2) With *casein*, the two species behave quite differently ; with the rat, a fixed weight is maintained with difficulty and death results from exhaustion rather than poisoning ; with the dog, on the contrary, the weight is easily maintained, but it soon clearly feels the toxic action, being unable to transform casein into fat so easily as does the rat.

3) With *meat powder*, a fixed weight, impossible to maintain with the rat, is easily attained with the dog.

The author interprets these facts as follows :— The dog, naturally a carnivorous species, adapts itself better to a purely protein diet than the white rat, a carnivorous and often vegetarian species. On the other hand, the nutritive value of a food is not of necessity connected with its poisonousness (as in the case of casein and the dog) ; the toxicity of a protein

varies from one species to another and seems to be in relation to the capacity they have of changing protein into fat. When this transformation capacity is reduced in a species, that species is much more sensitive to the toxic action, which affords a new proof of the important part played by fats in the utilisation of proteins.

**1196 - The Comparative Influence of Carbohydrates and Fats on the Utilisation of Food Proteins.** — MAIGNON, F., in *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 4, pp. 172-175 + 2 Tables. Paris, 1918.

As egg albumin alone can neither maintain a nutritive equilibrium nor a fixed weight, the author, using white rats as subjects, investigated the influence of added starch or fat on the properties of the albumin in question. He varied the relative proportions of the constituents of the two foods, albumin-starch and albumin-fat, and each day estimated the food ingested and every two days weighed the subjects in a fasting state. The observations obtained led to the conclusion that the addition of fat or starch compensates for the deficiencies of the egg albumin, but with unequal efficacy; the albumen is better utilised with the fat than with the starch, the mixture of 1 of albumin + 1 of fat giving better results than 1 of albumin to 1 of starch. When the rats were fed with the three nutritive elements, albumin, fat and starch, the mixture containing as much fat as albumin again gave the best results. The minimum of albumin required is 3 times less with fat than with starch.

The author observes that, in meat, the fat is present in a slightly lower proportion than albumin.

It may, therefore, be concluded that fats play an important part in the utilisation of proteins, and cannot be replaced by carbohydrates.

**1197 - On the Minimum of Sugar in the Diet and Hitherto Unconsidered Sources of Carbohydrates.** — BERRY, H. and PORTIER, P., in *Comptes rendus de la Société de Biologie*, Vol. LXXXI, No. 11, pp. 574-576. Paris, 1918.

The importance of certain amino-acids in the diet (1) and the question of vitamins have complicated the general problem of nutritive exchanges. The derangement of metabolism caused by shortage of carbohydrates during total fasting or abstention from carbohydrates has given rise to doubts as to the possibility of complete iso-dynamic substitution of carbohydrates by fat. The author's recent investigations appear to throw new light on the subject.

Rats subjected to a diet of coagulated white of egg, bacon or pure bacon fat, water and salts, maintain a fixed weight and show no appreciable illness, but acidosis sets in as soon as *the ratio of fat to albumin exceeds a certain proportion*.

The author explains this fact as follows:— at first sight it appears opposed to the classical results of abstention from carbohydrates, but a careful study shows that coagulated white of egg contains carbohydrates or substances which form these compounds (free sugar, glucosamine, etc. in

(1) On this subject see R. April and June, 1918, Nos. 442 and 658. (Ed.)

quantities of 8 to 10 gm. of these substances per 1000 gm. of fresh white of egg). On the other hand, the fat itself is a source of sugar; the glycerine may be changed into di-oxyacetone or triose sugar, and this last into a hexose by polymerisation (BERTRAND).

A diet composed of proteins and fat does, therefore, contain a certain quantity of carbohydrates of different origin so that there exists a *sugar minimum* just as there exists a nitrogen minimum. This minimum varies with the nature of the proteins, fat and sugars of the diet. A certain equilibrium between these factors is necessary to avoid metabolic disturbances.

**1198 - The Food Value of the Banana.**— PRESCOT, S. C. (Professor of Industrial Microbiology, Massachusetts Institute of Technology), in *The Scientific Monthly*, Vol. VI, No. 1, January, 1918, reprinted in *The Journal of the Board of Agriculture of British Guiana*, Vol. XI, No. 2, pp. 52-65 + 3 Tables. Demerara, April, 1918.

The banana is the principle source of carbohydrates in the diet of many tropical races, taking the place of the cereals and tubers of the diets of temperate zones. Numerous detailed investigations have shown the banana to give a larger unit yield in food material than wheat or any other crop. For this reason it must not be considered as a luxury but as one of the most important human foods, and should receive more consideration from physiologists and agriculturists than has hitherto been the case.

Many analyses have been made of the chemical composition of the edible portion of the fruit. The author gives the averages obtained by ATWATER and BRYANT (U. S. Department of Agriculture, Bull. No. 28, p. 71, 1906) which form a sort of general average of the composition of the different varieties (the banana usually eaten in the United States is the fruit of *Musa sapientum*):— Water, 75.3 %; protein, 1.3 %; fat, 0.6 %; carbohydrates, 22 %; ash, 0.8 %; calories per lb., 460.

An analysis of the ash made by the author gave the following results:— Silica, 2.19%; ferrous oxide, 0.18; lime, 1.82; magnesia, 6.45, sodium, 15.11; potash, 3.55; chlorine, 7.23; sulphur trioxide, 3.26; phosphoric acid, 7.68. The ash is, therefore, composed chiefly of phosphates, sulphates and chlorides of potassium, sodium, magnesia, and lime, i. e. salts which respond the best to the demands of the body. The banana contains all the substances necessary to maintenance, but its low protein and fat content as compared with the carbohydrate content do not make it possible for the banana *alone* to form a well-balanced ration. To remedy this defect it is sufficient to add milk or a small amount of meat to the ration.

The banana compares favourably with the best animal or vegetable foods; this is shown by a comparative table including widely-different foods. The analytical data given by ATWATER and BRYANT (*ibid.*, p. 68) for the potato are:— water, 78.3 %; protein 2.2 %; fat, 0.1 %; carbohydrates, 18 %; ash, 1 %; calories per lb., 385. These may be compared with the values given above for the banana, from which it is seen that the banana exceeds the potato by about 20 % in food value and calories.

It is commonly believed that the banana is indigestible if not cooked; this is only true if the fruit is insufficiently ripe and completely fallacious

for the completely ripe banana, as has been shown by many workers. The following figures which give the duration of *complete digestion* of various foods show that a ripe banana is digested more rapidly than the most common foods:—

Ripe bananas, 1 hour 45 minutes; vegetable marrow, 1 hr. 45 min.; onions 2 hr. 5 min.; beans, apples, 2 hr. 30 min.; green peas, 2 hr. 35 min.; oranges, 2 hr. 45 min.; oatmeal, 3 hr. 5 min.; roast mutton, 3 hr. 15 min.; boiled eggs, boiled potato, codfish, 3 hr. 30 min.; plums, 3 hr. 40 min.; nuts, 4 hr.; boiled beef, 4 hr. 15 min.; cabbage, 4 h. 30 min.; roast pork, 5 hr. 20 min.

The rapid digestion of the banana is caused by the fact that during mastication the carbohydrates are largely transformed to assimilable sugar in the mouth, and further transformation in the stomach requires comparatively little time. The banana is, therefore, not only richer in nutrients per unit of weight than many common foods, but is also more digestible.

For these reasons this fruit should be more largely consumed, especially under present conditions, when it might help to overcome the shortage of cereals and other carbohydrate foods. This is all the more easy as its production is abundant throughout the year, that it may be shipped long distances, may be eaten raw or cooked, as a fruit or a vegetable, and is one of the few foods the price of which has remained normal during the last years.

**1199—Foundation of a High School of Agriculture and Forestry in Indo-China; Prospectus of Subjects Taught.** — *Journal Officiel de l'Indochine Française*, Year XXX, No. 29 bis, pp. 689-694. Saigon, April 10, 1918.

AGRICULTURAL  
EDUCATION

The Governor General of Indo-China has issued a decree for the establishment in the colony of a High School of Agriculture and Forestry in order to train farmers and foresters capable of rationally managing the agricultural and forest lands of the country. A diploma will be awarded and will entitle the holders to enter the agricultural and forestry services of the colony. The different articles of the decree deal with the organisation of the school.

Entrance is by competition. The students must be not less than 16 years old and not more than 22 and must be able to show they are French subjects, under French protection, or Asiatic French citizens. They must also have one of the following qualifications: — “diplôme d'études complémentaires”, “brevet élémentaire” or “brevet supérieur de l'enseignement primaire”, “baccalauréat de l'enseignement secondaire”. The students receive a monthly maintenance grant.

The period of study extends over three years. The curriculum includes: 1) general instruction (1st year); 2) technical and professional instruction (2nd year); 3) special subjects (3rd year). The 1st year courses are attended by both agricultural and forestry students; they deal with physics, chemistry, botany, zoology, geology, agriculture, applied natural history, mathematics, mechanics, topography, book-keeping, horticulture and gardening.

The 2nd. year courses are divided into two distinct parts : — 1) theoretical part together with six months' practical work (economic botany, agricultural zoology, animal breeding, agricultural meteorology, agrology, rural economics, ethnography, and hygiene); 2) an essentially practical part lasting three months (cultivation of industrial plants, agrology, rural engineering, book-keeping and sericulture).

The 3rd. year is devoted to the study of special subjects. The students attend the courses and practical classes in a special school in Cochin-China. This school includes : 1) a museum ; 2) a demonstration farm with a model dairy ; 3) a model silkworm nursery ; 4) a bee hive ; 5) experimental and demonstration plots (rice, maize, coffee, tea, sugar cane, cotton, rubber, coconut) ; 6) laboratories (botany, chemistry, entomology, wood-testing) ; 7) a meteorological station ; 8) a tree nursery. At the end of the 3rd. year of study the students are examined in agricultural and forestry subjects. Each qualified student then works for a year either at an Agricultural Station (for agriculture) or at the Fuyen-Quang nursery, a sub-temperate forest (for forestry).

A detailed prospectus is appended to the decree.

## CROPS AND CULTIVATION.

### 1200 — Partial Correlation Applied to Dakota Data on Weather and Wheat Yield. —

AGRICULTURAL  
METEOROLOGY

BLAIR, T. A., in *Monthly Weather Review*, Vol. XLVI, No. 2, pp. 71-73. Washington, February, 1918.

In previous papers, the author showed for Dakota : —

1) The existence of a *positive* correlation between the total rainfall for May and June and the yield of spring wheat, the relative correlation coefficient  $r$  (1) being equal to  $+0.63 \pm 0.05$  in North Dakota and  $+0.59 \pm 0.06$  in South Dakota ;

2) the existence of a higher *negative* correlation between the total temperature for June and the yield of spring wheat ;  $r = -0.67 \pm 0.08$  for North Dakota and  $-0.73 \pm 0.07$  for South Dakota.

In addition to these two correlations the author calculated that between rainfall and temperature and always obtained negative values for  $r$ . In other words, to a wet May and June corresponds usually a cool June.

These preliminary data give rise to two interesting questions :

a) How much of the apparent relation between rainfall and yield is really due to the influence of rain and how much to the simultaneous action of temperature ?

b) How much of the apparent relation between temperature and yield is really due to the temperature and how much is due to the simultaneous action of rainfall ?

The two questions may be solved by the use of *partial correlation coef-*

(1) See R., February, 1918, No. 148, note at foot of p. 175. (Ed.).

*ficients* by calculating the correlation between two variable factors after the elimination of one or more other factors. In the present case, where there are three variables — rain, temperature, and yield — the partial correlation coefficient is represented by the formula:—

$$r_{\alpha\beta\cdot\gamma} = \frac{r_{\alpha\beta} - r_{\alpha\gamma} r_{\beta\gamma}}{\sqrt{(1 - r_{\alpha\gamma}^2)(1 - r_{\beta\gamma}^2)}}$$

Here the variables are represented by  $\alpha$ ,  $\beta$ ,  $\gamma$ . The terms  $r_{\alpha\beta}$ ,  $r_{\alpha\gamma}$  and  $r_{\beta\gamma}$  represent the *total* correlation between each pair of variables (e. g., between rain and yield, temperature and yield, etc.), and  $r_{\alpha\beta\cdot\gamma}$  represents the *partial* correlation between the factors  $\alpha$  and  $\beta$  after the factor  $\gamma$  has been eliminated.

If, using this formula, the factors rain, temperature and yield are represented by the letters  $p$ ,  $t$ , and  $y$ , the equations are:—

$$r_{py\cdot t} = \frac{r_{py} - r_{pt} r_{ty}}{\sqrt{(1 - r_{pt}^2)(1 - r_{ty}^2)}} \quad r_{ty\cdot p} = \frac{r_{ty} - r_{pt} r_{py}}{\sqrt{(1 - r_{pt}^2)(1 - r_{py}^2)}}$$

$$r_{pt\cdot y} = \frac{r_{pt} - r_{py} r_{ty}}{\sqrt{(1 - r_{py}^2)(1 - r_{ty}^2)}}$$

If the letters are replaced by their values, calculated by correlation tables, and the three equations resolved, the values given in the following table are obtained:—

	$r_{py}$	$r_{ty}$	$r_{pt}$	$r_{py\cdot t}$	$r_{ty\cdot p}$	$r_{pt\cdot y}$
North Dakota . . .	+ 0.61	— 0.45	— 0.38	+ 0.53	— 0.30	— 0.14
South Dakota . . .	+ 0.49	— 0.62	— 0.56	+ 0.22	— 0.48	— 0.37

It will be seen that the total correlation coefficient  $r_{py}$  between *rain-fall* and *yield* which in North Dakota is equal to + 0.61 and in South Dakota to + 0.49, is reduced to + 0.53 and + 0.22 respectively when the factor *temperature* is eliminated. A considerable part of the apparent effect of rainfall on the grain yield of spring wheat is, therefore, due to the simultaneous action of temperature. Similarly the coefficients for the effect of *temperature* only are — 0.30 and — 0.48 instead of — 0.45 and — 0.62.

The relation between the three factors under consideration is clearly seen. Moreover, the coefficients  $r_{py\cdot t} = + 0.53$  and  $r_{ty\cdot p} = - 0.30$  for North Dakota show the influence of rainfall to exceed that of temperature. This is the opposite to South Dakota where the coefficients + 0.22 and — 0.48 show the influence of temperature to be predominant. It is well known that the rainfall in May and June and the temperature of June are

not the only factors influencing yield. It is for this reason that the partial correlation coefficients considered, although high, are nevertheless far removed from unity ( $+1$  or  $-1$ ).

1200—**A Method Recommended in the Argentine for Avoiding Frost Damage to Cane Stools.** — ROSENFELD, A. H., in *Sugar*, Vol. XX, No. 5, pp. 182-183. Chicago, 1918.

In the province of Tucumán (Argentine) the early frosts which are frequent at the end of autumn or the beginning of winter (June 21) make it necessary nearly every year for planters to cut frost-bitten cane prematurely. Such cane contains more impurities and less saccharose than that cut at the end of July or the beginning of August. The bad effect of premature cutting is yet more marked on the crop of the following year. The stools cut in the middle or at the end of June begin to sprout very early in spring and the young shoots are attacked by frost and either killed or weakened in growth.

To estimate the damage thus caused the author carried out an experiment in a sugar plantation (striped cane). The methods of planting, cultivation, etc., were kept as uniform as possible and two harvests made, one on June 22, the other on August 2, 1912. The following year the cane was cut on July 24. Comparative figures of the yield and composition of the cane are given in the following table:—

Date of harvest  in 1912	Cane harvested on July 24, 1913								
	Yield in kg.		Stalks		Analysis of juice				Kg. of sugar per hectare
	per row of 100 m	per hectare	Number per row of 100 m	Average weight in kg.	Brix	Sac- charose	Glucose	purity	
June 22 . . . . .	350	23 100	519	0.76	17.6	15.8 %	0.1 %	89.6	2 290
August 2 . . . .	481	31 746	626	0.77	18.8	17.0 %	0.1 %	90.5	3 420

These results are absolutely convincing; plants cut in August, 1912 gave, in 1913, a yield per hectare exceeding that obtained with cane cut prematurely (June 22) by 8 500 kg. The injurious effect of frost is also clearly seen from the number of stalks per row of 100 m., plants cut in August 1912, yielding 107 more, in 1913, than those cut in June and, in spite of the close growth, these stalks weighed, on an average, slightly more than those cut in June. The August stalks also contained 1.2 % more saccharose and 1130 kg. more sugar per hectare.

It is quite clear that great advantage is to be derived from cutting the cane as late as possible, but, as has already been said, nearly every year the early frosts oblige the planters to harvest early. To remedy the disadvantages arising herefrom it is advised to cover stubble with soil by passing the plough between the lines. To test the benefit obtained from this method the author made an experiment in a plantation of purple sugar-cane with



alternate plots of 4 covered and 4 uncovered rows. Below are given the results obtained the following year.

	Cane harvested in 1913							
	Yield in kg.		Stalks		Analysis of juice			
	per row of 100 m	per hectare	Number per row of 100 m	Average weight in kg.	Brix	Sac- charose	Glucose	kg. of sugar per hectare
Uncovered stubble	545	35 970	700	0.79	18.8	17.0 %	0.1 %	90.5
Covered stubble.	599	39 534	719	0.83	19.3	17.8 %	0.1 %	91.9

This method is, therefore, satisfactory. The earth-covered plots yielded 3 500 kg. of cane per hectare and 650 kg. of sugar per hectare more than the uncovered plots. The method is recommended wherever practicable as it is both easy and inexpensive.

**1202 - Relation of the Density of Cell Sap to Winter Hardiness in Small Grains.** — See No. 1217 of this Review.

**1203 - Investigations into Flocculating Power in Soil.** — I. MASONI G., Coagulating Action of some Soluble Salts on Clay in Soil, in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 247-293 + Bibliography of 30 Publications, Modena, 1917. II. LEONCINI, G. and MASONI, G., Determination of the Flocculating Power of Soil Solution, *Ibid.*, pp. 406-420.

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

I. An experimental study of the following three phenomena, which may be closely related : — A) flocculating power of soluble salts on clay in soil ; B) influence of this flocculation on the permeability of the soil ; C) absorption of part of the flocculating electrolytes as a result of flocculation. The study was limited to the action of certain neutral salts which are of the greatest interest from an agricultural point of view, either as essential constituents of fertilisers or because of their solution in waters which come into contact with the soil, such as chlorides, nitrates, sulphates of sodium, potassium, ammonium and calcium. Ordinary soil not too rich in clay and poor in organic matter was used. It was first dried in the air, then sifted to remove the fine particles.

**CONCLUSIONS.** — A) Chlorides have a greater flocculating power than equal weights of nitrates which, in their turn, are superior to sulphates. Calcium salts have more flocculating power than those of potassium and ammonium, and these more than sodium salts.

There is no ratio between the weight of salts used and their flocculating action. There is, however, a close relation between the solution of a given salt, the ion concentration and the degree of dissociation of the solution. The flocculating power of each salt decreases with the increase in the ion concentration, dissociation decreasing at the same time; there is no simple ratio between these phenomena. The flocculating action of the salts tested is due exclusively to the cations and the clayey matter acts as a negative

colloid. It is clear that, as the anions take no part in the flocculation the various cations act diversely.

Concentration and dissociation being equal, salts with *identical cations* and *different anions* have the same flocculating power. If only the dissociation is equal the flocculating power varies with the concentration and, if only the concentration is equal it varies with the dissociation. If both the concentration and dissociation vary, the flocculating power increases when both of these increase; it also increases when the concentration increases at the same time the dissociation decreases. There is, however, no simple ratio between the first and second ratios.

The flocculating power of salts with *identical anions* and *different cations* depends neither on dissociation nor concentration. The difference in the flocculating power of the chloride, nitrate and sulphate of the same metal does not depend on the anion, but solely on the cation, dissociation, and concentration. The *valency of the cation* has a relative influence on the flocculating power, but not the *atomic weight* of the different elements. The *relative unitary* flocculating power of each cation decreases as the concentration increases (but not in a simple ratio).

Taking the flocculating power of sodium (Na) as equal to 1, the relative unitary flocculating power of the other elements may be fixed approximately as follows:— Potassium (K), 2.4; Ammonium (NH<sub>4</sub>), 2.4; Calcium (Ca), 5.7.

B) The modifications in the permeability of the soil caused by saline solutions have no direct relation to the flocculating power of these solutions on clay, even in the case of very thick layers of soil and relatively concentrated solutions.

C) During the flocculation of the clay particles fixation of the active elements occurs, but it is not yet known if this fixation is due to the flocculation itself, i. e., to simple *adsorption*, or to an *exchange* of the elements mentioned with other elements of matters acted on by the salts.

II. — When studying the properties of soils it would be advantageous, in addition to the chemical analyses and physico-chemical investigations into the *aqueous solution*, to determine easily and rapidly the *flocculating power of this solution*. Taking as a basis the flocculation of kaolin by this solution the authors evolved the following rapid method:—

In an APPIANI levigator are placed 0.5 gm. of very fine kaolin, 200 cc. of the solution to be tested added and the whole shaken for 30 minutes and left to stand for 6 hours. The thick liquid is then poured into a flask and the amount of kaolin in suspension determined by the difference between the residue left by 100 cc. of the thick liquid evaporated to dryness at 105°C. in a platinum dish and the residue left, under the same conditions, by 100 cc. of the solution examined. The smaller the amount of kaolin in suspension, the greater should be the flocculating power of the solution examined, so that, all else being equal, it may be considered as inversely proportionate to the amount of kaolin in suspension and, in comparison with distilled water, be expressed by the formula  $Pf = \frac{A}{S}$ , where *Pf* represents the flocculating

power to be determined,  $A$  the weight of kaolin left in suspension in the distilled water, and  $S$  the weight of kaolin left in suspension in the solution examined.

**1204 - The Action of Neutral Salts on Humus and other Experiments on Soil Acidity.**

— GILLESPIE, L. J. and WISE, L. E. (Laboratories of the Office of Soil Fertility, Bureau of Plant Industry, U. S. Department of Agriculture), in the *Journal of the American Chemical Society*, Vol. XL, No. 5, pp. 796-813 + 1 Fig. Easton, Pa., May, 1918.

The investigations described deal with the action of neutral salts on humus and the behaviour of litmus paper towards different acid solutions, and were made to determine the nature of soil acidity. The addition of chlorides of sodium, potassium or barium in solution greatly increases the hydrogen-ion concentration determined electrically. As, however, this increase in acidity is also observed, though to a lesser extent, when potassium chloride acts on true solutions, saline or acid, containing no humus or other undissolved substances, great care must be taken in drawing conclusions as to the process of the phenomenon where humus is concerned. With equal concentrations barium chloride has the greatest effect on the electrometric potential of humus preparations although it has not been definitely proved that barium acts more strongly than potassium on humus.

Great care must also be taken when determining the acidity of soils with litmus paper because, even in greatly diluted solutions of hydrochloric acid, the result is largely influenced by the neutralising action of the solution analysed.

It is improbable that soils can act on litmus paper by their adsorptive power alone. The difference observed between moist soil and its aqueous extract is probably attributable to the slight solubility of the organic substances of the soil.

It is not possible at the present time to give any general explanation of soil acidity, but the determination of truly acid soils by the hydrogen electrode and suitable indicators may be considered reliable although the data on the adsorption or action of neutral salts on soils is still negative. The litmus paper test applied to moist soils may give results of a certain practical value if the necessary precautions are observed. The subsequent choice of simpler methods is connected with a deeper knowledge of the relation between the hydrogen-ion concentration, on which the true acidity of soil depends, and their various biological activities (1).

**1205 - Isolation of Cyanuric Acid from Soil, in the United States.** — L. WISE, L. E. and WALTERS, E. H. (Bureau of Plant Industry, U.S. Department of Agriculture), in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 85-91 + 1 Fig. + Bibliography of 13 Publications. Washington, July 9, 1917.

While examining a sample of Indiana silt loam the authors isolated a nitrogenous organic compound, cyanuric acid ( $C_3H_3N_3O_3$ ). It was identified by comparing in detail its properties with those of synthetic cyanuric acid, prepared by heating urea in the presence of zinc chloride (VON WALTHER'S method).

(1) See *R.*, Nov. 1917, No. 996. (Ed.).

The largest amount of this acid found was 0.150 gm. from 23 kg. of soil, but the amount was reduced by losses during evaporation. Subsequently cyanuric acid was found in various soils from different districts: — a Maine loam soil in which potatoes were grown (0.165 gm. of acid from 46 kg. of soil), in a Florida sand soil in which oranges were grown (0.04 gm. from 23 kg.), in a Texas soil (0.04 for 46 kg.) identical with that from which the authors isolated  $\alpha$ -crotonic acid (1). Cyanuric acid has apparently never previously been isolated from a natural source. It is suggested that it may be formed in soil, by the decomposition of nucleoprotein or purin bases.

1206 — **New Observations on the Biological Absorption of Methane and the Distribution of Kaserer and Söhngen Methane Organisms in Soils, Mud and Farm Manures.** — GIGLIOLI, I. and MASON, G., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 76-108. Modena, 1917.

In nature methane is produced in large quantities by the decomposition of vegetable detritus and, as it is only slightly soluble, should pass almost entirely into the atmosphere, where, as a matter of fact, only slight traces of it occur. This leads to the supposition that in soil and water it undergoes actions which change it rapidly. The investigations of M. W. BEIJERINCK and A. VAN DELDEN (1903) gave the first experimental proof of the existence of soil micro-organisms (especially *Bacillus oligocarbophilus*) capable of feeding on gaseous hydrocarbons. Later the work of H. KASERER and N. L. SÖHNGEN showed more definitely that methane really is absorbed by soil micro-organisms. From his first cultures SÖHNGEN was able to isolate a special bacillus which he called *Bacillus methanicus*.

The great interest of SÖHNGEN's experiments led the authors (1906-07) to verify them and to specify some of the conditions under which absorption of methane occurs and to collect observations on the distribution of *Bacillus methanicus* in the soils of Pisa, Italy, and its surroundings. They began their study with a few preliminary tests, followed by two sets of experiments at different seasons. In the first set (March 1-April 4, 1906) they studied the phenomenon in the presence of sewer contents and the mud of the Arno. In the second (April 30-July 30, 1907) the study was extended to field soil taken at various depths, fresh manure, rotted manure, and liquid manure, working in the light, in the dark, at a constant temperature of 30°C or average room temperature, as well as in the presence of an antiseptic (chloroform). Experiments were also undertaken to verify whether gaseous hydrocarbons other than methane could be absorbed. For all the experiments SÖHNGEN's purely mineral culture fluid was used; it contains for 100 parts of distilled water, 0.01 of calcium sulphate, 0.1 of ammonium chloride, 0.05 of magnesium-ammonium phosphate, 0.05 of bi-potassium phosphate.

RESULTS. — In the first place they confirm those of the early experiments of KASERER and SÖHNGEN, that is to say, that methane, in the presence of oxygen, is absorbed by soil bacteria. Its absorption and oxi-

(1) See *R. Jan.*, 1917, No. 6. (*Ed.*).

dation are biological phenomena which exclude the action of a soluble ferment or soil enzyme.

Light does not appear to have any special action on this biological absorption of methane which, however, is favoured by temperatures above that of the air and the surface of the soil, especially by temperatures round 30° C. Different varieties and species of methane bacteria seem to exist and act at different temperature.

In ploughed field and meadow soil, organisms which oxidise and absorb methane are rare and not very active on the surface, whereas they are abundant and active in the lower layers. They may also be in large numbers in river mud (of the Arno, for example). Manure (especially rotted and moistened), liquid manure, and sewer contents also contain many methane bacteria. Thus manure well dug in should help to enrich the soil in micro-organisms which prevent the loss of methane by forming, at its expense, new organic matter.

**CONCLUSIONS.** — Methane soil bacteria by preventing the total loss of methane of which they transform, in part at least, into new fixed organic matter either within their organisms or in their products, help to supply the soil with organic matter closely mixed with the constituents most favourable to fertility.

In appendix is given a chronological list of 82 works consulted on the origin and circulation of methane in nature and the connection of this gas with vegetable life. Some of these publications are briefly summarised.

**1207 — Experiments on the Influence on the Fertilising Power of Sewage of the Bacteria it Brings to the Soil.** — MASONI, G., in *R. Università di Pisa, Istituto di Chimica Agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 295-327 + Bibliography of 22 Publications; Modena, 1917.

MANURES  
AND MANURING  
ANTICRYPTO-  
GAMIC  
PRODUCTS

The aim of the experiments described was to determine whether more or less sterilised sewage exercises on the soil an influence different from that of natural sewage. In one series of experiments the sewage was spread over the earth, in another it was mixed with the earth which was placed in earthen pots containing 26 lb. In the experiments were used:—

- 1) Pots without sewage.
- 2) Pots with sewage in the natural state.
- 3) Pots with sewage sterilised by boiling.
- 4) Pots with sewage partially sterilised with sulphuric acid at the rate of 1 % of their weight.
- 5) Pots with sewage treated with an amount of sodium sulphate corresponding to 1 % of sulphuric acid.

The better to determine the action of the micro-organisms of the sewage, earth completely sterilised by heating to 130-140°C. for 8 hours was used in the following group of pots:—

- 6) Pots with sterilised soil unmixed with sewage.
- 7) Pots with sterilised soil mixed with natural sewage.
- 8) Pots with sterilised soil mixed with sewage sterilised by boiling.

In this group the sterilised soil of the pots was moistened before beginn-

ing the experiment so as to give it the same moisture content as the natural soil.

**RESULTS.** — The second set of experiments especially (sewage mixed with soil) showed the following facts with respect to the yields and condition of the plants, not including the fertilising power of the sewage itself :—

A) *Experiments with soil in the natural state.* — 1) Sterilised sewage gave much better results than natural sewage.

2) Sewage treated with 1 % of sulphuric acid gave almost the same results as sewage sterilised by boiling.

3) Sewage treated with sodium sulphate gave better results than those with natural sewage but, on the whole, slightly inferior to boiled sewage and that treated with sulphuric acid.

B) *Experiments with sterilised soil.* — Pots with natural sewage gave higher yields, not only than the control pots, but than the pots with sterilised sewage.

*Comparison between experiments A and B.* — 1) Of the control pots, those with sterilised soil always gave higher yields than those with natural soil, especially for maize.

2) With natural sewage buckwheat gave almost the same yields in both natural and sterilised soils, while maize yielded more in sterilised soil.

3) When boiled sewage was used sterilised soil was always inferior to natural soil.

**CONCLUSIONS.** — Partial or complete sterilisation tends to increase the fertilising action of sewage.

The two facts : — a) that sterilised sewage gave better results in natural than in sterilised soil ; b) that natural sewage gave better results than sterilised sewage in sterilised soil, lead to the conclusion that, although sterilised soil of itself tends to give yields equal or superior to those obtained in natural soil, an organic fertiliser free from micro-organisms has always more effect in surroundings containing micro-organisms capable of acting on it.

Other experiments, in which the earth of the pots was aerated, confirmed on the whole the above results. This calls for a continuation of the study of the influence the bacteria brought into the soil by organic fertilisers may exercise, particularly on the phenomena of nitrification and denitrification.

1208 — **Experiments on the Action of Manganese Dioxide on Nitrogenous Organic Substances, Especially Amides, With a View to the Use of this Dioxide as a Fertiliser.** — LEONCINI, G. and PIERI, C., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 328-248. Modena, 1917.

A description is given of experiments *in vitro* made to determine whether oxidation of the nitrogenous organic substances is among the many actions of which manganese dioxide is capable in soil with respect to vegetation.

**RESULTS.** — Ammoniacal compounds are in no way oxidised by manganese dioxide. On the other hand, the amides of the fatty acids and urea in

aqueous solution are easily oxidised at boiling point with the formation of nitric acid and with the same intensity in an alkaline, acid or neutral solution but, at 30°C, oxidation hardly takes place (only slight traces of ammonia are sometimes formed), except in the case of the dicyanodiamide which at this temperature also gives slight traces of nitric acid.

Amino-acids in aqueous solution are not acted on at all by manganese dioxide. They give no nitric acid at 30°C or at boiling point whether their solution be neutral, alkaline, or acid.

The amides of the amino-acids act similarly. In only one substitution derivative of an amino-acid (hippuric acid) is a tendency of part of the acid to form ammonia noticed.

Finally, uric acid and its xanthine and hypoxanthine derivatives are slightly acted on by manganese dioxide; this is seen at times only from the formation of small quantities of ammonia.

**CONCLUSIONS.** — In most of the above-mentioned compounds the nitrogen link with the rest of the molecule is so strong that it makes the molecule refractory to the oxidising action of manganese dioxide at either the relatively low temperature of 30°C, or even at boiling point, at least from a point of view of the transformation of nitrogen into nitric acid.

In the amides of the fatty acids and some of their polymers such as dicyanodiamide, the link between the amide group and the acid radical is weak, and, in several cases it suffices to boil them with an alkali or an acid to produce, by hydrolysis, the breaking up of the amide into ammonia and fatty acid. This would explain why manganese dioxide acts on such amides as a vigorous oxidiser, capable of transforming amide nitrogen into nitric nitrogen at boiling point, but to ammonia only at 30°C.

It is, then, almost certain that, apart from the small quantities of ammonia slowly transformed by the manganese dioxide, even at a temperature of 30°, if this dioxide were placed in the soil, where the temperature practically never exceeds 30°, it would have no direct oxidising effect of any practical importance on the nitrogenous organic matter. The dioxide may, however, have a very useful action by forming as a result of special environmental conditions, colloid solutions with an indirect diastatic action, by seconding the activity of bacteria, the specific agents of the various oxidations produced in soil, and, more specially, that of nitrifying bacteria.

**1209 — Analysis of Phosphatic Fertilisers.** — I. MASONI, G., Contribution to the Study of the Adulteration of Bone Superphosphates, in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*, Pt. 22 (1909-1914), pp. 139-170. Modena, 1917. — II. QUARTAROLI, A. and ROGAI, A., On the Use of Ammonium Citrate in the Determination of Phosphoric Acid. *Ibid.*, pp. 427-443.

I. — As bone superphosphates have a higher commercial value than other phosphatic fertilisers they are naturally more subject to adulteration. The author proposes a simple method to determine such adulteration which, though not general, gives useful and sometimes decisive results.

**PRELIMINARY TESTS.** — A little of the substance is carefully charred in a porcelain dish then calcined in a platinum dish which is removed now and again from the flame. Pure bone superphosphate gives off no white

steam. When, after prolonged calcination, the substance is still incandescent, pure bone superphosphate should not give a deep yellow colour which subsequently disappears, but should remain whitish or, at the most, yellowish. After cooling the calcined residue should remain white or have a paler reddish tinge. It is completely soluble in warm 10 % hydrochloric acid or, should a very small part remain undissolved, the solution should become perfectly clear after standing a little while.

**QUANTITATIVE AND QUALITATIVE TESTS.** — The moisture, total  $P_2O_5$ , water and citrate soluble  $P_2O_5$ , total  $SO_3$ , and residue insoluble in aqua regia are determined. Reducing the results to a dry matter basis at  $100^\circ C$  the values are:— $ST = \frac{\text{total } SO_3}{\text{total } P_2O_5} \times 100$  and  $SS = \frac{\text{total } P_2O_5}{\text{soluble } P_2O_5} \times 100$ .

In good bone superphosphate these values should not exceed 130 and the difference  $ST - SS$  should not be great. If the values of  $SS$  and  $ST$  are much below the minimum of 110 the purity of the product is doubtful and precipitated phosphates have probably been added. A percentage of 1.3 for the residue insoluble in aqua regia is already high.

In some doubtful cases the following *summary tests* may be useful:—see whether the aqueous solution gives a strong reaction to chlorine (precipitated phosphates); observe with a magnifying glass whether the water-insoluble residue contains carbon particles (ashes, etc.); test whether the superphosphate effervesces with acids; in special cases determine the pyrophosphoric acid (large quantities show the presence of pyrophosphates or superphosphates derived from them).

II. — The authors studies the value of determining phosphoric acid in superphosphates and basic slags by the ammonium citrate instead of the molybdate method. It was shown that, in the case of basic slag, the citrate method may sometimes lead to serious errors, although there are two sources of error which often tend to balance each other — precipitation of magnesium ferrites or citro-ferrites and incomplete precipitation of phosphoric acid. If the results disagree and the precipitates are not perfectly white and amorphous after calcination, it is possible, by estimating the iron, to determine whether errors are due to its presence. In such a case, elimination of the iron before precipitation by means of "cupferron" (ammoniacal salt of nitroso-ferri-hydroxylamine) might give reliable results. Nevertheless, this method is not generally applicable, in practice, to commercial analyses.

In the rarer cases, where iron or aluminium phosphates are concerned, the citrate method is not applicable. The principle consisting in precipitating phosphoric acid in the presence of iron or aluminium in any case or at any concentration, by preventing the precipitation of these metals by citric acid may give rise to grave errors.

The existence of the phenomena studied by the authors does not compromise the present citrate method for estimating  $P_2O_5$  in superphosphates except in a few exceptional cases of superphosphates rich in aluminium. Nevertheless these phenomena should be borne in mind in doubtful cases. The facts studied show that the choice of the concentration and quantity of solutions to be used fixed by the Italian official method is very happy, as



different amounts of ammonium citrate and n. a. g. e. s. i. m. mixture might give rise to great difficulties. The authors are, however, of opinion that, in view of the influence of its concentration on the formation of abnormal precipitates, the composition of the magnesium mixture should be more exactly fixed.

1210 - The Production and Consumption of Copper Sulphate and Copper Products in Italy (1) — FASOLATO, N. (Inspector of Industry and Work at Turin), in the *Bollettino dell'Ispettorato dell'Industria e del Lavoro*, Vol. VIII, Nos. 1-2, pp. 36-64 + 3 Diagrams. Rome, 1917.

The author's paper entitled "*Cenni sommari sugli impianti per la fabbricazione del solfato di rame esistenti nel Regno (Continente)*" (Notes on the Copper Sulphate Factories in Italy) gives information of the copper sulphate and "Caffaro paste" industry in Italy.

In the manufacture of copper sulphate refined or commercial copper is used, besides sulphuric acid, and, as accessories, electrolytic copper, scrap copper, cupriferous sand, cement copper and copper slag.

The process of manufacture may be outlined, thus:—Copper—> furnaces—> tanks for granulating the copper—> towers for treatment with sulphuric acid or other acids—> crystallisation vats—> washing and centrifugalisation of the sulphate. To produce 100 lb. of copper sulphate are required, theoretically, 25.53 lb. of pure copper and, in practice, 25.78 lb. of 99 % commercial copper.

"Caffaro paste" is a fungicide with a basis of oxychloride of copper prepared by the "Società elettrica ed elettrochimica del Caffaro" by treating copper in a special apparatus with chlorine (by-product from the SOLWAY process for the preparation of caustic soda) and transforming the copper chloride obtained into oxychloride in special mixing-mills. The present works can produce 98 400 cwt. of "Caffaro paste" containing 16.1 to 16.5 % of copper in seven months. The consumption of this paste during twelve months (from August till the end of July of the following year) was:—1913-14, 10 190 cwt.; 1914-15, 25 085 cwt.; in 1915-16, 45 080 cwt. The principal markets are Emilia, Piedmont, Venetia, Tuscany, Lombardy, the Marches, Apulia and Sicily.

In Italy there are 17 factories producing copper sulphate, including that of "Caffaro paste". During the year 1915-16 their daily output was 6 829 cwt, representing 80.5 % of the declared production capacity, 8 346 cwt. These 17 factories belong to 11 firms and are not distributed in conformity with the needs of the districts for, whereas those of Piedmont and Liguria, where 8.3 % of all the Italian vineyards is situated, supply 65 % of the total production, those of Lombardy and Venetia, where there is 20.7 % of the vineyards, produce 19.4 %, and those of central and southern Italy, where there is 71 % of the total vineyards, produce only 15.6 %.

The following table shows the trade in copper sulphate.

(1) See R., 1914, No. 108. (Ed.)

	Averages for the years 1904-1914	Year 1914-1915	Year 1915-1916
Production of Italian factories . . . . .	759 250 cwt.	807 527 cwt.	1 471 139 cwt.
Importation into Italy . . . . .	429 041	259 662	127 180
<i>Total quantity available</i> . . . . .	<b>1 288 296 cwt.</b>	<b>1 067 189 cwt.</b>	<b>1 598 319 cwt.</b>
Exportation from Italy . . . . .	26 679	5 860	112
<i>Estimated consumption in Italy</i> . . . . .	<b>1 176 610 cwt.</b>	<b>1 077 089 cwt.</b>	<b>1 607 148 cwt.</b>
Importation, in percentage of the estimated consumption . . . . .	39 %	26.5 %	8 %

It may be admitted that each year Italy consumes on an average 1 182 800 cwt. of copper sulphate, with a maximum, which is not likely to be exceeded, of approximately 1 608 000 cwt. estimated for the season 1915-16 (1).

The 17 factories already mentioned are capable of producing, in 173 working days, all the copper sulphate required for consumption in normal times and, in 234 days, the amount necessary for years of maximum consumption. Estimating that each factory can give 250 working days each year, the Italian factories should be able to produce over 1 706 000 cwt. of copper sulphate, which would be sufficient to supply the maximum consumption as well as to export about 108 000 cwt. There are probably many reasons why, in spite of the large production of the Italian factories, copper sulphate is imported from abroad, but the author holds they may all be eliminated, and it is especially important to do so because when importing copper sulphate the crystallisation water (which represents over  $\frac{1}{8}$  of the weight of the salt) is included in the payment, so that it is much more profitable to import the corresponding quantity of metallic copper.

The chief expenses in the manufacture of copper sulphate are:—cost of copper delivered to the factory (including freight, transport from Genoa to the factory, and unloading), cost of manufacture, interest and other expenses for the capital used in buying the copper, brokerage fees incurred in buying the copper, eventual rising of prices to balance the drop which may occur the following season in the price of prepared sulphate. The profit is obtained from the difference between the estimated cost of the copper sulphate and its selling price. A table of the prices of copper sulphate, illustrated by a diagram, clearly shows the greatly preponderant influence exercised on them by the cost of the metallic copper.

(1) See the half-yearly reports published by the International Institute of Agriculture under the title: *International Trade of Fertilisers and Chemical Products Employed in Agriculture*. (Ed.)

1211 — The Relationship between the Constituents of the Ashes of Plants Diversely Fertilised.—LEONCINI, G., in *R. Università di Pisa, Istituto di Chimica agraria, Studi e Ricerche*. Pt. 22 (1909-1914), pp. 225-245. Modena, 1917.

This paper describes preliminary investigations into the influence of certain elements and radicals added to the soil on the elements of the ashes of the plants grown in such soil. The investigations were limited to determining whether the amount of calcium and magnesium absorbed by the plant as well as their ratios, may be modified in the ash by increasing the quantity of certain elements and radicals assimilable by the plant in the soil.

Duplicate tests were made in two series of six pots each containing 10 kg. of ordinary field soil to which had been added calcium nitrate and magnesium nitrate, so that its content in these two bases should be increased. Maize was first grown, then buckwheat without further addition of fertilizer. Each series of six vases was made up as follows:—

No. 1)	Calcium nitrate + magnesium nitrate
No. 2)	» » + » » + disodium phosphate
No. 3)	» » + » » + potassium sulphate
No. 4)	» » + » » + bi-potassic phosphate
No. 5)	« « + » » + manganese sulphate
No. 6)	» » + » » + ferrous sulphate.

RESULTS. — An examination of the quantity of certain mineral constituents of the ashes shows that, under the conditions of the experiment, there would be a close relationship between the composition of the ash and the fertilizer, especially as concerns the Mg (magnesium) and  $\text{PO}_4$  (phosphoric) ions, a fact already well known. The relationship between the Mg and  $\text{PO}_4$  ions is greatly influenced by the abundance of the K (potassium) ion in the soil, and probably by a larger assimilation of potash. As the assimilation of magnesium is much influenced by the action of the potassium ion the assimilation of phosphoric acid must also be influenced, not only by the calcium and magnesium ions, but also by the potassium ion.

Under the experimental conditions, in the presence of large quantities of calcium and magnesium, cultivated plants tend to assimilate, in proportion to green matter, the same quantities of  $\text{PO}_4$  ion, whether the soil has received phosphatic fertilizer or not. If the soil has received potassic salts as well, the quantities of magnesium assimilated vary considerably. The addition of phosphoric acid compounds to the soil causes a slight decrease in the assimilation of calcium ion in proportion to the green matter of the plant.

CONCLUSIONS. — Four ions —  $\text{PO}_4$  (phosphoric), Mg (magnesium), Ca (calcium), and K (potassium) — appear to be fairly definitely connected with each other with respect to assimilation by plants. In order to decide the question the quantitative tests must be extended to a large number of elements by varying the fertilizers more rationally and comparing the variations of the assimilable element with the quantitative variations of the salts added to the soil. The author is now carrying out such experiments.

**1212 — Relation between the Total Phosphoric Acid and that of the Lecithins in Different Varieties of Peas.** — HALÁSZ, P., in the *Biochemische Zeitschrift*, Vol. I, XXXVII, Nos. 1 and 2, pp. 104-106 + 3 Tables. Berlin, 1918.

To determine the relation between the total phosphoric acid content and the phosphoric acid content of the lecithins in different varieties of a leguminous plant the author analysed the seed of different varieties of peas. He found that, in certain varieties, the lecithin content may reach 2.34 % and that the varieties most rich in lecithins are those the ripe seed of which is green, i. e., those rich in chlorophyll. These varieties contain relatively little starch. The yellow seed varieties are less rich in lecithins, but contain more starch.

There is a close relation between the total phosphoric acid content and the phosphoric acid content of the lecithins. The first is six or seven times greater than the second (six times more in peas rich in starch grains and seven times more in green peas rich in lecithins). If the total phosphoric acid content of a variety of pea be known it is, therefore, possible to determine approximately its lecithin content.

**1213 — "Sarothamnine" and "Genisteine", New Alkaloids from the Scotch Broom.**

— VALEUR A., I. On the Presence of a fixed Alkaloid in the Scotch Broom, in *Comptes Rendus de l'Académie des Sciences*, Vol. CLXVII, No. 1, pp. 26-28. Paris, July 1, 1918.

— II. On a New Volatile Alkaloid in the Scotch Broom, *Ibid.*, No. 4, pp. 163-164. Paris, July 22, 1918.

I. — Only very rarely is one alkaloid found in a plant; it might almost be said that plurality is the rule. If there are exceptions it is because one of the alkaloids is present in such a preponderating quantity that the isolation of the others presents serious difficulties. This was the case with nicotine, for long considered the only alkaloid in tobacco, until M. AMÉ PICTET showed the presence of several other alkaloids in crude commercial nicotine. The same took place with *sparteine*, extracted by STENHOUSE in 1851 from the Scotch broom (*Sarothamnus scoparius*) and which appeared to be the only alkaloid present.

The author has isolated from the two last mother-lyes obtained in successive crystallisations of *sparteine*, when they are no longer fit for obtaining the salt by concentration, two new bases, one fixed, one volatile. The first, called *sarothamnine* by the author, is considered in the present note.

The author describes the extraction method by which he obtained a white, well crystallised product by a combination of chloroform and the new alkaloid, and fine white crystals obtained by a combination of ethyl alcohol with the alkaloid.

The formula of *sarothamnine* is  $C_{15} H_{24} N_2$ , that of *sparteine* being  $C_{15} H_{26} N_2$ .

*Sarothamnine* has a remarkable facility of combining with certain solvents; it combines with methyl alcohol and with benzene, giving crystalline compounds. The author was unable to obtain the base free in the crystalline state. *Sarothamnine* acts as a monoacid to phthalein. The cold sulphuric solution clearly reduces a weak solution of potassium

permanganate; the base is, therefore, not saturated. It is an isomer of spartyrin, a base obtained by the careful oxidation of sparteine.

The author concludes: — 1) given the action of the high temperature (250° C) used in extracting sarothamnine, it is possible that the base itself does not exist in the broom, but is produced by the decomposition or transformation of an alkaloid, possibly oxygenated; 2) the formula given is provisory, as the alkaloid has not yet been completely studied.

II. — The author has isolated a fixed alkaloid, sarothamnine, from the mother-lye of the crystallisation of commercial sparteine sulphate. With an excess of soda lye, then exhaustion by ether, he was able to isolate, besides a large amount of sparteine, another volatile alkaloid, *genisteine*, a laevo-rotatory base with the formula  $C_{16}H_{28}N_2$  which, with the addition of one molecule of water, forms a hydrate which may be obtained in large crystals.

1214 — Hydrocyanic Acid Content of the "Pe-gya" Burma Bean (*Phaseolus lunatus* var.) and its Estimation. — See No. 1227 of this Review.

1215 — Studies on the Evolution of the Sweet Principles of Sorghum: Sugar Content at the Various Stages of Growth and the Influence of Castration. — BERTHELOT, D. and TRANNOY, R. — I. The Sugar Content of Sorghum at the Various Stages of its Growth, in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVI, No. 20, pp. 824-827 + 1 Diagram; II. The Evolution of the Sweet Principles of Sorghum and the Influence of Castration, *Ibid.*, No. 22, pp. 907-910. Paris, May 21 and June 2, 1918.

This paper deals with experiments, carried out at the Plant Chemistry Station of Meudon (department of Seine-et-Oise, France), on the sugar content of sweet sorghum (*Sorghum saccharatum*) at the various stages of its development. The seeds were sown on April 25, 1917, and analyses made from lots of five plants.

The primary reducing sugars (glucose and laevulose) were the first to appear, their quantity gradually increasing until towards August 24 the total quantity of both sugars was 4 to 5 %. Saccharose, which was not present at the beginning, appeared towards August 10 and developed at first at the expense of the already existing glucose and laevulose. This is a new example of the synthesis of saccharose in the plant at the expense of the primary monoses, in agreement with the process reported long ago by BERTHELOT and BUIGNET during the ripening of oranges (1).

On October 5 the saccharose content reached 14 % and remained between 12 and 14 % during 6 weeks, a content a little below that of common sugar beets. During this period the flavour of the juice, which was at first slightly acid and astringent, became pleasant and decidedly sweet.

During the second fortnight of November the tissues began to die; the vegetable juices mingled and the hydrating diastases they contain caused hydrolysis of the saccharose, which partially returned to the state of glucose and laevulose; so that the content of these two sugars was higher at the end of vegetation.

(1) *Comptes rendus de l'Ac. des Sc.*, Vol. 51, p. 1094, 1860, (Author):

This retrogression is yet more marked in cut sorghum, i. e., in the dead plant, and is especially rapid after a frost followed by a rise in temperature, which cause the rupture of the cellular membranes. This is one way in which sorghum is inferior to beet and sugar cane. Another not less serious one is the great difficulty in crystallising sorghum juice. When small saccharose crystals were mixed with the juice evaporated to a syrupy consistency, crystallisation did not finish for several weeks; at the end of six weeks it was still incomplete.

The density increases regularly with the sugar content. If the juice contained only sugar principles in solution, the excess ( $d-1$ ) of the density over that of the water would be about proportionate to the sugar content. There is in the juice a quantity of saline principles, relatively weak as compared with the sugar principles, but sufficient to raise the density to 1.0025. The sugar content,  $s$ , from 8 % onwards at any rate, is fairly well represented by the formula  $s = 2(d - 1.0025)$ . This allows the variations in the sugar content to be controlled by an estimate of the density, i. e., by a much more simple process than a volumetric analysis with cupro-potassium solution or by a polarimetric measurement.

The suppression of the inflorescences has been recommended on the ground that it would increase the sugar content by avoiding the loss of that part of the sugar which changes to starch in the seed. The author's experiments on this subject were negative; castration did not increase the sugar content.

**CONCLUSIONS.** — It does not seem that, in normal times, sorghum can compete with the beet or sugar cane. The sweet juice of sorghum is inferior in many ways. First of all, it is difficult to crystallise, both by reason of the large proportion of so-called uncrystallisable sugars (glucose and laevulose) and the presence of gummy matter. Secondly, as soon as the plant is cut and the tissues die a large proportion of the saccharose again breaks up into glucose and laevulose; this phenomenon even occurs in the plant in the ground at the end of vegetation. Cut sorghum, is, therefore, more difficult to keep in silos than beet or cane, and treatment must not be postponed too long.

From a botanical point of view it must be noted that sorghum is reproduced annually from seed and is not so regular in growth as beet, which is biennial, or cane, which is reproduced vegetatively.

Sorghum is, however, a very hardy plant, easy to cultivate, which does well even in the north of France, and the sweet-juce, which may be extracted with presses at home, and can be used unprepared, as a syrup, would be a useful addition in the household under the present conditions caused by the war.

1216 — **The Effect of Tobacco Smoke and of Methyl Iodide Vapour on the Growth of Certain Microorganisms** (1). — LUDWIG, C. A., in the *American Journal of Botany*, Vol. V, No. 4, pp. 171-177 + Bibliography of 7 Publications. Lancaster, Pa., April, 1918.

During experiments on bacteria and fungi the author observed the

(1) See No. 1220 of this *Review*. (Ed.).

action of tobacco smoke and methyl iodide vapour on the development of the following micro-organisms: — *Bacillus subtilis*, *B. pyocyaneus*, *B. Kiliensis*, *B. rubidus*, *B. melonis*, *B. mycoides*, *B. campestris*, *Pseudomonas radicicola*, *B. carotovorus*, *Oidium lactis*, etc. The influence on each of these is described.

It may be concluded that tobacco smoke is more or less toxic to the micro-organisms used but, in view of the very variable composition of tobacco smoke it is difficult to determine to which substance or group of substances the toxic action is due. When tobacco smoke had been passed through one or more wash bottles its toxicity is much smaller. This suggests that certain substances which can be condensed or dissolved in water take part in the toxic action.

Methyl iodide vapour causes, at first, a marked delay in development, followed by very vigorous growth, if of course, it is not sufficiently abundant to sterilise the culture medium.

**1217 — Relation of the Density of Cell Sap to Winter Hardiness in Small Grains; Investigations in the U. S. A.** — SALMON, S. C. and FLEMING, F. L., in the *Journal of Agricultural Research*, Vol. XIII, No. 10, pp. 497-506 + 1 Plate. Washington, June 3, 1918.

The death of plant tissues from cold may be due to: — 1) the formation of ice in the intracellular spaces; 2) physiological drought; 3) precipitation of the proteids; 4) desiccation of the protoplasm. In each case an increase in the electrolytic contents of the sap should increase the resistance of the plants to cold by lowering the freezing point and reducing transpiration. A close connection between the density of the sap and the resistance of the plant to low temperatures seems, therefore, probable. To study whether such a connection really exists in cereals the authors made a series of experiments with rye, wheat, emmer, barley and oats. The experiments were divided into three groups:—

*Group I.* — The sap was extracted by pressure after maceration or treatment with chloroform or toluene. A first determination, made with material collected on November 27, 1915, gave the following figures for the depression of the freezing point: —

	Freezing point
1) Rye. . . . .	— 1.044° C.
2) Durum wheat, Kharkof variety . . . . .	— 1.230° C.
3) Soft wheat, Fultz variety . . . . .	— 1.076° C.
4) Emmer ( <i>Triticum dicoccum</i> ), Black Winter variety . . . . .	— 1.012° C.
5) Barley, Tennessee Winter variety . . . . .	— 1.117° C.
6) Oats, Culberson Winter variety . . . . .	— 1.199° C.

No relation was observed between resistance to cold and sap density. It is true that the maximum depression of the freezing point is found in Kharkof wheat, which is very hardy, but Culberson oats, which are very sensitive to cold, also have a high coefficient, surpassing that of rye. These coefficients are, however, by no means constant, for in another determination made on December 17, 1915, Kharkof wheat had the lowest freezing point, —0.935°, whereas those for the other plants were: rye, —1.175°;

Fultz wheat  $-1.44^{\circ}$ ; barley  $1.320^{\circ}$ ; Winter Turf oats  $-1.260^{\circ}$ ; Culberson oats  $-1.445^{\circ}$ .

*Group II.* — Results similar to the preceding ones were obtained without extracting the sap from the plants. The leaves were wrapped round the thermometer bulb, which was then placed in the freezing mixture. Three successive determinations were made:— 1) January 16, 1917: rye,  $-3.56^{\circ}$ ; barley,  $-2.59^{\circ}$ ; 2) January 19: Kharkof wheat,  $-3.47^{\circ}$ ; rye,  $-3.58^{\circ}$ ; 3) January 27: Kharkof wheat,  $-2.17^{\circ}$ ; Fultz wheat,  $-2.06^{\circ}$ ; rye,  $-2.10^{\circ}$ . The depression of the freezing point is, therefore, greater than for extracted sap. The differences between the kinds of grain do not, however, indicate any relation between the sap concentration and resistance to cold.

*Group III.* — A study was made of the effect on the depression of the freezing point of the turgidity of the tissues which, all else being equal, has a tendency to lower the resistance of plants to cold. Wheat and oat seedlings grown in greenhouses were carefully uprooted and divided into two groups:— 1) before making the determination the seedlings were exposed to sunlight for two or three hours at room temperature, so that the leaves wilted partly; 2) the roots were immersed in water so that the leaves remained turgid. The values found for the depression of the freezing point were:—

	Lot 1 Wilted plants	Lot 2 Turgid plants
Turkey durum wheat . . . . .	$-1.945^{\circ}$	$-1.405^{\circ}$
Fultz soft wheat. . . . .	$-1.930^{\circ}$	$-1.308^{\circ}$
Winter oats. . . . .	$-2.160^{\circ}$	$-1.230^{\circ}$

The difference between the freezing point of wilted and turgid plants of the same species is much greater than that between those of different species of equal turgidity. There is, therefore, an inverse correlation between the turgidity of the tissues and concentration of the sap.

1218 — *The Action of Ultra-Violet Rays on Sugar Cane, Pineapple and Banana, in Hawaii.* — TSUJI, T., in *The Louisiana Planter and Sugar Manufacturer*, Vol. LX, No. 26, pp. 413-414 + 1 Table. New Orleans, June 29, 1918.

The author made a prolonged study of the action of ultra-violet rays on plant physiology. In the paper under review he describes his recent investigations which show perfectly clearly the connection between the action of these rays and the formation of carbohydrates, acids and other compounds in sugar cane, pineapple, banana, and other tropical plants.

**SUGAR CANE.** — Perfectly normal sugar canes were grown in the dark at a temperature of  $22^{\circ}\text{C}$ .; they grew but became pale. Thirty days later they were divided into two lots, one of which was exposed to direct sunlight, the other to ultra-violet rays from a quartz mercury vapour lamp. The etiolated leaves subjected to the action of ultra-violet rays turned a deep green after  $2\frac{1}{2}$  hours, whereas those exposed simply to sunlight kept their yellow, etiolated colour.



In another experiment three lots of sugar cane were planted. One was covered with coloured glass (to intercept 50 % of the ultra-violet rays of the sunlight), the second was exposed normally to sunlight, and the third to the combined action of the sunlight and that of the mercury vapour lamp. These three lots received equal amounts of fertiliser. After several months the second lot was found to contain 30 % more sugar than the first, and the third lot 8 % more than the second. The increase in the weight of the sugar of each lot respectively in a given time points to the possibility of reducing the 20 months normally required for each sugar harvest to less than one year by the use of ultra-violet rays.

**PINEAPPLE AND BANANA.** — Pineapples exposed to the action of ultra-violet rays ripen more rapidly than those exposed to sunlight only. Pineapples were subjected to the action of ultra-violet rays for 40 minutes each morning; the fruit was riper, more juicy and larger than that exposed to sunlight only. The same favourable action was observed on the banana. Banana leaves and stalks which had been cut and placed in water kept their original freshness even after two weeks when they had previously been subjected to the action of ultra-violet rays, whereas other untreated material was faded completely after six or seven days. The author sees in this a means of preventing the deterioration of exported bananas, but lays stress on the care necessary in the treatment as the distance, duration and intensity have to be very carefully regulated to prevent bad effects.

**PRACTICAL SOURCES OF ULTRA-VIOLET RAYS.** — The ultra-violet rays of sunlight are quickly absorbed by the atmospheric gases, and only a small proportion of them reaches the surface of the earth. The use of mercury lamps is too expensive for practical application. The author, therefore, has attempted to devise more economical methods. In his latest system the ultra-violet rays are derived from small carbon rods impregnated with sodium tungstate, uranium nitrate, ammonium molybdate and titanous chloride.

**1219 — Physical Factors of Tropism.** — DUFRÉNOY, J., in the *Revue générale des Sciences*, Year XXIX, No. 15-16, pp. 430-451. Paris, August, 1918.

The numerous investigations into tropism have shown the direction and intensity of geotropism and phototropism to depend:— 1) for a given individual, on the physical factors of the environment; 2) for given ecological conditions, on the physico-chemical properties of the cellular constituents of the individual.

Heliotropism may be modified by internal secretions and traumatic and parasitic actions affecting cellular nutrition. Lateral branches of trees which are normally horizontal may become geotropic when the top is destroyed or if attacked by parasites. For example, lateral branches of pine attacked by *Aecidium clatinum* acquire a negative geotropism, whereas branches of Scotch pine, cluster pine and spruce, borne on a level with galls of *Coccus resinifians* on the trunk, become positively geotropic.

LOEB, having observed the geotropic curve to be closely connected with the presence and position of leaves on the stalk, deducted from this the hypo-

thesis of the existence of special substances, or geotropic "hormones" that pass from the leaf to the tree, thus causing its geotropic curve.

The author considers this hypothesis neither justified nor necessary. In many completely leafless plants the floral stem curves even more rapidly than in plants with leaves. The author has made a new study of the question and his results lead him to interpret geotropic curving more simply:—

It is the result of unequal surface growth. The rate of geotropic curving and the rate of growth depend on the turgescence of the tissues and are, therefore, proportionate to the rate of absorption of water. It is for this reason that the curving and growth, rapid in stems standing in water, are slower in those standing in saline solutions and absent in plants deprived of water.

1220 - **Artificial Budding of Roots.** — MOLISCH, H., in the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften in Wien, Mathematisch-naturwissenschaftliche Klasse, Abteilung I*, Vol. CXXVI, Pt. I, pp. 3-13 + 2 Plates. Vienna, 1917.

Although much work has been done on causing artificially the budding and growth of leaves (1) little attention has hitherto been given to this artificial budding of roots and few observations have been made on the periodical formation of roots in perennial plants (2). Moreover, the few results published do not, as a rule, agree and make it impossible to determine whether, during the winter, the roots enter a period of rest independent of outward conditions or whether they do not develop in winter as a result of unfavourable environment. If the branches of species with a marked tendency to produce adventitious roots no longer show this tendency in autumn or winter, *in spite of the presence of factors favourable to growth*, and demand some method of forcing before showing it, the hypothesis of rest independent of outward conditions, or "spontaneous" rest, would be confirmed. The author attempted to verify this by the following method: — freshly cut branches, one to three years old, of species easily producing adventitious roots (*Salix*, *Populus*, *Philadelphus coronarius*, *Viburnum Opulus*) were subjected during September, October and November to the action of substances called by the author "Treibstoffe" (substances causing budding) — hot water, tobacco and paper smoke. After treatment the branches were exposed for one or two hours in the open air, then placed in a greenhouse at a temperature of 12 to 20°C, or in a thermostat at a temperature of about 25°C.

A comparison of the branches subjected to treatment and the control branches showed that exposing the branches to tobacco smoke for 24 hours, to paper smoke for 48 hours, or to a warm water bath (at 30°C.) for 12 hours causes the leaves to fall more rapidly and the appearance, a few weeks later, of numerous adventitious roots. The control branches showed only a few small adventitious roots or none at all as may be seen from the photographs reproduced. The author concludes that there is a period during which the roots have, so to speak, no further tendency to grow; this is their period of

(1) See R. Jan., 1916, No. 62. (Ed.) — (2) See R. April, 1917, No. 313. (Ed.)

rest. This period does not, however, always depend on the presence of unfavourable factors, but is very often "independent", such as that of the budding of leaves, since, for two kinds of organs the same "activating" substance ("Treibstoffe") may shorten the period and cause budding.

**1221 - The Influence of Pollinisation and other External Factors on the Floral Organs and the Flowering Period; Research in Japan.** — MORITA, KOICHI, in *The Botanical Magazine*, Vol. XXXII, No. 375, pp. 39-52 + 6 Tables + 10 Figs. Tokyo, March, 1918.

The paper describes research work on the influence of pollinisation and other external factors (mechanical and physico-chemical) on the modification of the floral organs and the duration of the flowering period. Many tropical Orchidaceae present certain physiological phenomena which show this influence. The author chose a Japanese species — *Cymbidium virens* — which responds to the following factors by fairly strong reaction:—

1) INFLUENCE OF POLLINISATION. — This influence is felt in several ways:— the flowering period is lengthened; the stigma closes completely; the gynostemium swells; the ovary swells and lengthens.

2) INFLUENCE OF DEAD POLLEN AND POLLEN EXTRACT. — Dead pollen, killed by boiling water or chloroform, when placed on the stigma also causes it to close and the gynostemium to swell, but does not influence the duration of flowering. The author concludes that dead pollen contains active principles which are very stable with regard to heat and chloroform. For this reason he studied the influence of these extracts (small balls of cotton soaked in pollen extract obtained with hot, distilled water, placed on the stigma cavity) and found the influence to be the same as that exercised by dead pollen, except that the gynostemium does not swell.

3) INFLUENCE OF MECHANICAL FACTORS. — The placing of grains of sand on the stigma, or the artificial wounding of the gynostemium, have no effect on the flower of *Cymbidium virens*; this is contrary to the results obtained with other tropical species.

4) INFLUENCE OF THE POLLEN OF OTHER PLANTS. — Pollen from other species of the same family (Orchidaceae) has, so to speak, the same effect as pollen from the same species. On the other hand, pollen belonging to species of other families (*Prunus*, *Narcissus*, *Salix*, etc.) give absolutely negative results.

5) INFLUENCE OF CHEMICAL MATTERS. — Mineral matter has no effect; organic matter (fatty acids and certain sugars) seem to have some effect on the stigma, but the reaction has not yet been clearly demonstrated.

**1222 - Experiments on "Pneumatocarps".** — BAUMGAERTEL, O., in the *Sitzungsberichte der Kaiserlichen Akademie in Wien, Mathematisch-naturwissenschaftliche Klasse, Abteilung I*, Vol. CXXVI, Pt. I, pp. 13-40 + 4 Figs. + 1 Plate + Bibliography of 20 Publications. Vienna, 1917.

The author undertook a series of experiments on fruits which, as a result of internal gas pressure, present an abnormal growth due to the swelling of the pericarp. The author calls all fruits, of very different species, which show this inflation "pneumatocarps" ("Pneumatokarprien"), and he has studied the phenomenon from a morphological, biological and physiological point of view.

The presence of gas within the fruit may be ascertained, by pressing with the finger or pricking holes in the skin. The gases seem to be formed by the combustion of carbohydrates owing to respiration. DE NEGRI'S analytical investigations gave the following figures for the composition of these gases: —  $\text{CO}_2$ , 9.88 %; O, 16.59 %; N, 73.53 %. If these values are compared with those given for atmospheric air ( $\text{CO}_2$ , 0.04 %; O, 20.81 %; N, 79.19 %) the gas in the pericarp is seen to be much richer in  $\text{CO}_2$ . Respiration takes place in all the tissues where carbohydrates can accumulate. The author carried out a microscopical study of the tissues of "pneumatocarps" in order to determine the connection between the histological conformation of the fruits and the formation of the gases they contain. His studies on the following species:— *Astragalus Cicer* L., *Colutea halepica* Lam., *C. orientalis* Mill., *Nigella damascena* L., *Staphylea Bumalda* D. C., *S. pinnaia* L., led him to distinguish three types:—

1) *Staphylea* TYPE:—centre of respiration in the mesocarp and osmotic phenomena through the endocarp.

2) *Nigella* TYPE:—centre of respiration in the mesocarp and "setting free" ("Ablösung") of the impermeable endocarp on the one hand with formation of gas by the respiration of the embryos on the other.

3) *Leguminosae* TYPE:—centre of respiration first in the numerous embryos, then localised particularly in the meatic tissues of the placenta and funiculus, with the result that the endocarp may become the seat of respiration.

The biological importance of the internal air of "pneumatocarps" consists partly in forming a moisture-saturated environment favourable to the development of the embryos, and partly in causing the formation of fruit which is both as developed as possible and as light as possible. This is a great advantage if the action of the wind as a factor favouring reproduction be considered.

#### PLANT BREEDING

1223 - **Inheritance of the Characters of the Endosperm in Hybrids between Hard and Soft Wheats in the United States.** — FREEMAN, G. F., in *The Journal of Heredity*, Vol. IX, No. 5, pp. 211-226 + 5 Figs. Washington. May-June, 1918.

It is known that, in wheat grain with a high content of gluten as compared with that of starch, the constituents remain cemented together when the grain is completely ripe, thus giving it a compact texture and a translucent, glassy appearance. When the gluten content is not high enough to cement the mass of the endosperm completely the decreased volume of the grain is not sufficient to compensate for the loss in moisture so that air spaces occur and the grain remains soft and opaque.

The author distinguishes two types of soft grain according to the appearance and distribution of the air spaces:—

1) "true softness" type, in which the air spaces are finely scattered throughout the endosperm; it is only slightly affected by external factors.

2) "yellow berry" type, in which the air spaces occur in groups with well-defined margins; in these opaqueness may be confined to a small spot or include the whole endosperm.

The results are given of a series of experiments carried out to determine

the conditions governing the transmission of these characters. Numerous crossings were made between soft and hard wheats and the progeny analysed as far as  $F_4$ .

I. — EXPERIMENTS WITH WHEATS OF THE "TRUE SOFTNESS" TYPE. The cross hard Algerian wheat I  $\times$  Sonora 35, a soft American wheat, gave, in  $F_1$ , plants with intermediate characters, in which the maternal and paternal characters graded into each other, passing in a regular series from almost hard to almost soft wheat.

Two hybrids were chosen from  $F_1$ :— a) No. 16-1 with 23 % of hard grain and 77 % of soft and intermediate grain; b) No. 16-5, with 14 % of hard grain and 86 % of soft and intermediate grain. From each of these hybrids were sown separately:— 1) hard grain; 2) soft grain; 3) naturally mixed grain (soft, hard and intermediate). Table I shows the composition of the  $F_2$  obtained.

TABLE I. — *Composition of the  $F_2$   
of the cross hard Algerian wheat I  $\times$  Sonora 35 soft wheat.*

$F_1$ seed used for sowing		Number of $F_2$ plants with		
		all hard seed	hard, soft and inter- mediate seed	all soft seed
The hard seed {	of No. 16-1 produced in $F_2$ . . . .	12	12	1
	of No. 16-5 " " . . . .	7	7	1
The soft seed {	of No. 16-1 " " . . . .	—	14	3
	of No. 16-5 " " . . . .	4	13	5
The mixed seed {	of No. 16-1 " " . . . .	11	36	17
	of No. 16-5 " " . . . .	19	39	10
Total progeny of the cross I $\times$ 35 . . .		682	1251	336
Percentage of plants per class . . .		30 %	55 %	15 %

Although the progressive passage from one type to another makes the analysis and grading of the descendants difficult the following facts may be discerned:—

1) Selected hard seed tends to produce progeny with hard or mixed seed with a decrease or absence of completely soft seed.

2) Selected soft seeds tend to produce progeny with soft or mixed seed with a decrease or absence of completely hard seeds.

These facts become still clearer in the following generations. Thus, in 1915, a plant (No. 16-5-1-15) was isolated from the  $F_2$  of No. 16-5 which had 28 % of hard seed and 72 % of soft and intermediate seed. Table II shows the composition of the  $F_3$  obtained.



berries is small the opaque spots are small but when the percentage is high the spots are large and cover the whole endosperm.

The factors governing the appearance of yellow berry have not yet been defined or analysed. From their nature and behaviour it is, however, certain that they differ greatly from those governing "true softness" and are very sensitive to outside influence. There is no doubt that the tendency to produce yellow berries is inherited; this was proved by the experiment made from 1914-1916 with 145 pure strains of Turkey wheat. A comparison of the percentages of yellow berries in the different years of the experiments gave the following correlations:— 1914 and 1915:  $+ 57\% \pm 4\%$ ; 1915 and 1916:  $+ 33\% \pm 5\%$ ; 1914 and 1916:  $+ 41\% \pm 5\%$ . All these figures are more than six times greater than the probable error.

1224 — On a Case of Permanent Variation in the Glume Lengths of Extracted Parental Types and the Inheritance of Purple Colour in the Cross *Triticum polonicum*  $\times$  *T. Eloboni*, in England.— ST. CLAIR CAPORN, A., in the *Journal of Genetics*, Vol. VII, No. 4, pp. 259-280 + 2 Plates. Cambridge, August, 1918.

The characters of the two parents used for the cross are:—

*Triticum polonicum*:— Average glume length, 29.23 mm. Grain white, long and pointed, with a deep furrow.

*T. Eloboni*.— Average glume length, 10.58 mm. Grain short, stumpy and hard; pigmentation of the cells of the pericarp.

A) GLUME LENGTH. —  $F_1$  generation. — The glumes were intermediate in shape and size to those of the parents, but varied greatly above and below the average.

$F_2$  generation. — There were three types of glumes:— a) as long or short as those of the parents; b) almost as long or short as those of the parents; c) intermediate between those of the parents. In reconstructing the polygons of variations (1) with respect to glume length a curve with three distinct points is obtained, thus showing that segregation of the characters has taken place. According to Prof. BIFFEN (2) this curve results from the overlapping of three separate curves representing the lengths of 1) homozygous short, 2) long, 3) heterozygous short-long glumes respectively. This phenomenon is seen more clearly in  $F_3$ .

$F_3$  generation. — The seed of 183 heterozygous  $F_2$  ears were sown in separate rows. In  $F_3$  170 rows were obtained containing sufficient plants to give the following classification:—

	Number of $F_3$ lines	
	found	calculated by the ratio 1 : 2 : 1
Short glumes . . . . .	41	42.5
Short, medium and long (mixed). . . . .	87	85.0
Long glumes . . . . .	42	42.5

(1) See R. Sept, 1918, No. 973. (Ed.). — (2) BIFFEN, R. H., in the *Journal of Agricultural Science*, 1905 (Ed.).

An examination of  $F_3$  confirmed the observations made with  $F_2$ , namely, that the numbers found agree very well with those calculated and with the ratio 1 : 2 : 1 of monohybrids.

A further fact proved unmistakably is worthy of attention. In plants with long glumes, such as those of the parent *Triticum polonicum* which reappear in the  $F_2$  and  $F_3$ , the average length of the glumes (24.15 mm.) is always below that found in the parent (29.23 mm.). Similar results are probably obtained with short glumed plants, with the difference that the average length of their glumes should exceed that of the parent *Triticum Eloboni*. There is reason to believe that this shortening and lengthening of the glumes observed in the long glumed and short glumed plants of the  $F_2$  and  $F_3$  remains unchanged throughout all the generations.

B) GRAIN COLOUR. —  $F_1$  generation. — All the hybrids had the purple colour characteristic of *Triticum Eloboni*.

$F_2$  generation. — Grain with purple streaks on a light ground occurred. There were 28 plants with purple grain, 8 with streaked grain and 136 with uncoloured grain, corresponding to the ratio 3 : 1 : 12. The ratio is relatively simple, but the small number of purple-grained plants in spite of the dominance of this colour in the  $F_1$  is surprising.  $F_3$  is yet more complicated.

$F_3$  generation. — Numerous data on the colour of the grain are given and closely investigated. Nevertheless the author concludes that none of the ratios observed in the  $F_3$  can compare with the ratio 3 : 1 : 12 obtained in the  $F_2$ . None of the hypotheses put forward to explain these phenomena by multiplying the number of chromatic, inhibitory, developing factors, etc. give a satisfactory explanation and the problem of the grain colour in crosses between *Triticum polonicum* and *F. Eloboni* remains unsolved.

#### 1225 — Experiments on the Structure of Common Rice and Gluten Rice, in Japan.

— YASUKÉ, Y., in *The Botanical Magazine*, Vol. XXXII, No. 377, pp. 83-90. Tokyo, May, 1918.

By crossing common rice with gluten rice (1) an  $F_1$  was obtained composed of plants with all the external characters of common rice and an  $F_2$  with  $\frac{3}{4}$  of the plants resembling common rice and  $\frac{1}{4}$  similar to gluten rice. These facts seem to point to dominance of common rice, yet, an analysis of many  $F_2$  plants showed that the grains of the "common rice" type were not all similar but could be sub-divided into two groups:—

*Group 1.* — The endosperm of the grain is translucent and when treated with an iodine solution of potassium iodide immediately turns blue. These are characters belonging to common rice and plants of this group must be considered *homozygous* (AA).

*Group 2.* — The grains, with semi-translucent endosperms, give a red to reddish violet colour with iodine; they are intermediate between those of common rice, which are translucent, and those of gluten rice, which are opaque (BB), and should be considered *heterozygous* (AB).

The genetic data on descendants of grain which is considered hetero-

(1) Of the variety known in Cochin-China as "Nep".



zygous in respect of the above-mentioned characters, fully confirm the author's hypotheses. In six different cases the  $F_2$  showed simultaneously plants of the "common rice" and of the "gluten rice" types, in the ratio 1:2:1 observed in cases of monohybridism. The general average obtained was 1056 plants of the "common rice" type, 1740 hybrids (heterozygotes), and 884 of the "gluten rice" type. The corresponding theoretical numbers were 910, 1820, 910.

In conclusion, the above-mentioned facts seem to show that the dominance of common rice over gluten rice is incomplete, but to prove this definitely, the  $F_1$  and  $F_2$  must be analysed. This the author proposes to do.

#### 1226—The Inheritance of Tight and Loose Paleae in *Avena nuda* Crosses, in England.

— ST. CLAIR CAPORN, A., in the *Journal of Genetics*, Vol. VII, No. 4, pp 229-246 + 6 Figs. Cambridge, 1918

Results of a series of reciprocal crosses made between *Avena nuda* and three varieties of ordinary oats — Thousand Dollar, Ligowo, and Nubian Black — with the intention of studying the inheritance of the characters "tight" and "loose" paleae.

CHARACTERS OF THE PARENTS. — *Avena nuda*. — Long, dangling spikelets with as many as 9 flowers; loose, tree, membranous white and grey paleae from which the grains are easily detached.

The three following varieties have tight paleae:— Thousand Dollar Oat. — Two-grained spikelets, rarely 3- or 4-grained. Inner paleae thin but stiff, the outer thick and curled round the edges of the inner.

Ligowo Oat. — Like Thousand Dollar, save that it tends more to form 3-grained spikelets and its grain is plumper.

Nubian Black Oat. — Is a shorter strawed oat than the two previously described.

$F_1$  GENERATION. — The panicles contained a varying proportion of many-flowered spikelets of the "nuda" type, and, in the basal regions, the 2-flowered spikelets predominated.

The paleae showed every conceivable gradation from the "pure tight" of the tight grained parents to the wholly membranous palea.

The percentage of "pure tight" ranged from 20.4 to 68.7%; that of the "pure looses" from 7.8 to 46.8%. The rise of the one appears to be correlated by the fall of the other, not only when different plants are compared, but also in different zones of the same plant, as are shown in the proportions found in one plant:—

1st. node of the panicle	. . .	67.0 %	pure tight:	6.1 %	pure looses
2nd.   "   "   "   "	. . .	45.8 %	"   "	20.8 %	"   "
3rd.   "   "   "   "	. . .	26.8 %	"   "	39.0 %	"   "
4th.   "   "   "   "	. . .	5.0 %	"   "	45.0 %	"   "
Last.   "   "   "   "	. . .	7.4 %	"   "	44.4 %	"   "

This gradual diminution in the number of tight paleae and increase in the number towards the tip is a tendency noticeable in every heterozygous panicle.

In the case of Nubian Black  $\times$  *Avena nuda* the  $F_1$  colour was a bright

brown sometimes overlaid with a faint greyish flush. This may be due to the fact that the black parent is really made up of at least 3 different kinds of blacks, represented zygotically by the formulae  $BB\ B'B'\ GG$ ;  $BB\ B'B'\ gg$ ; and  $BB\ b'b'\ gg$ , where  $B$  and  $B'$  are factors for blackness, and  $G$  for grey colour.

In the  $F_1$  of the cross between *Avena nuda* and the white oats Thousand Dollar and Ligowo, the plants raised were a mixture of greys and whites, with dominance of grey in the cross grey  $\times$  white.

$F_2$  GENERATION. — This contained pure tights and mixed individuals. The proportion of plants with all grains tight were as follows:—

- 1) Out of 213 *Avena nuda* ♀  $\times$  Thousand Dollar ♂, 64 plants.
- 2) Out of 172 Ligowo ♀  $\times$  *Avena nuda* ♂, 49 plants.
- 3) Out of 133 *Avena nuda* ♀  $\times$  Ligowo ♂, 31 plants.

There were thus 518 plants with free paleae and mixed paleae, against 144 with all grains tight, in the ratio of 3 : 1, as was confirmed by further analysis.

$F_3$  GENERATION. — The plants of mixed type of the  $F_2$  gave in the  $F_3$ , the following types:—

I. — *Pure tights*. — All the grains on the plants enclosed in tough, wholly sclerotised paleae.

II. — *Tight-containers*. — One or more "pure tight" paleae, the rest varied.

III. — *Hard backs*. — No "pure tight" pales. Paleae partly membranous, partly stiffened, the hard portion varying from a slightly thickened midrib to the stiffening of nearly the whole palea.

IV. — *Penulti-looses*. — As in type III but the hardening is never found above the lowest palea in any of the spikelets. These verge closely on the

V — *Pure looses*. — All paleae absolutely membranous. These 5 types were distributed as follows in the  $F_3$ :—

$F_2$ crosses	As in $F_2$					Total $F_3$ plants
	Type I	Type II	Type III	Type IV	Type V	
Thousand Dollar ♂ $\times$ <i>Avena nuda</i> ♀ . . . . .	283	610	161	61	18	1133
<i>Avena nuda</i> ♂ $\times$ Ligowo ♀ . . . . .	163	341	113	24	16	657
Ligowo ♂ $\times$ <i>Avena nuda</i> ♀ . . . . .	164	359	95	25	12	65
Totals . . . . .	610	1310	369	110	46	2445

As might have been expected the pure tights make up almost exactly  $\frac{1}{4}$  of the total.

Type II is really a mixture of 2 distinct types; it contains some plants that never throw pure tights, as is shown on analysing the progeny. The author found that 78 out of 1310 are of Type II. On adding these 78 plants to the numbers 369 + 110 + 46 of Types III — IV — V, we get a total

of 603. In this way, the respective numbers of plants of types I, II and III — IV — V, i. e., 610 — 1232 — 603, would be in the ratio of 1 : 2 : 1, showing that *complete* tightness is determined by a single independent factor.

But what is it that causes the heterogeneity of the 603 plants of the types III — IV — V, which have the one common property of being unable to give rise to pure tights? On adding the number of plants of Types IV and V, we get 156, or about  $\frac{1}{4}$  of the total 603. This proportion shows that other factors must be coming into play, assumed by the author to be 3 in number: **X** = a factor capable of rendering *all* the paleae on the plant pure tight; **Y** = a factor capable of rendering some of the paleae on the plant pure tight; **Z** = a factor capable of rendering some of the paleae on the plant more or less sclerotised but never wholly tight.

All the pure tight forms must be homozygous to **X**, no matter whether they contain **Y** or **Z** or not. Similarly all plants which never throw pure tights must be recessive for **X** (their formula would be **xx**). On crossing these 2 types, we get a large number of  $F_1$  combinations (e. g., **XYZ x yZ**; **Xyz xyz**; **XYZ xyz**), all with a constant feature: the heterozygosity of **X**. In the  $F_2$  there is  $\frac{1}{4}$  of pure tight plants, and  $\frac{3}{4}$  of variably tightened paleae according as **Y** and **Z** are present both homozygously, both heterozygously, one homozygously and one heterozygously and so on, or both absent. It should be added that the functions assigned to the factors **Y** and **Z** are merely hypothetical.

**NUMBER OF SPIKELETS.** — Tight pales have the advantage of holding the grain and thus preventing it from being shaken out; it is thus a character of great agricultural value, which it would be desirable to combine with the many-flowered habit of the *Avena nuda* spikelets. Unfortunately the author has found that there is an absolute incompatibility between these two characters, as the food material which might be used to produce the additional grains is used up instead to strengthen the paleae.

**COLOUR OF THE PALEAE.** — There is no repulsion between grey or brown colour and pure tight paleae, though the author had previously thought there was, judging from the material studied.

1227 — Selection of a Type of "Pe-gya" Bean (*Phaseolus lunatus* var.) with a Low Prussic Acid Content, in Burma. — WARTH, F. J., and KOKOGYI, in the *Agricultural Research Institute, Pusa, Bulletin* No. 79, 11 pp. + 6 Tables. Calcutta, 1918.

The bulletin under review gives the results of a series of selection experiments aiming at the isolation of strains or types of "Pe-gya" (Burma bean, a variety of *Phaseolus lunatus*) poor in prussic acid so as to avoid, if possible, the cases of poisoning attributed to this bean by London firms.

One hundred "Pe-gya" plants were collected from the Sagaing district and the prussic acid (HCN) content of the seeds determined by the following analytical method:—

The glucoside was extracted from the finely-ground seed with alcohol. The alcoholic extract evaporated to dryness, was taken up with water, hydrolysed with dilute acid, then distilled over a water bath, air being bubbled through during the process. The hydrogen cyanide thus obtained was absorbed by 30 cc. of sodium bicarbonate solution. The distillate was then

brought up to a volume of 400 to 500 cc. with water, 30 cc. of normal potassium hydroxide and 16 cc. of an aqueous solution of ferrous sulphate added, and the whole shaken at regular intervals for three hours. The liquid was then acidified and left to stand for some days till the Prussian blue was completely precipitated. The precipitate was filtered, washed with a small amount of alkali and the Prussian blue re-precipitated. If the amount of Prussian blue was small it was determined colorimetrically, if large it was collected on a filter, ignited and weighed as ferric oxide ( $\text{Fe}_2\text{O}_3$ ).

While making these determinations large differences were noted in the prussic acid content of the seed. For selection purposes eight plants were chosen, two with a low HCN content (0.0004 to 0.0012 %), two with a high content (0.0138 to 0.0347 %) and four with a medium content (0.0018 to 0.0030, 0.0112 %).

There was no difference between the size, shape, or colour of the beans; they all consisted of a mixture of brown mottled seed with seed of a more uniform brown. No correlation could, therefore, be found between the external characters and the prussic acid content which would simplify selection by avoiding long and difficult analyses. Seed from each of these eight plants was sown in three districts with widely different climates: 1) Mandalay, in the arid zone; 2) Hmawbi, in the wet Irawaddy delta zone; 3) Tatkon, in Central Burma, where the rainfall is intermediate.

*Percentages of prussic acid in the seed of the parent plants and those of the descendants.*

Parent plants	Descendants				
	Mandalay			Hmawbi	Tatkon
	1st sowing	2nd sowing	3rd sowing		
Lot I . . . 0.0004 . . . { 1	—	—	0.0008	—	0.0010
	2	0.0008	0.0012	0.0010	0.0015
Lot II . . . 0.0012 . . . { 3	—	0.0016	0.0015	—	0.0016
	4	0.0016	0.0021	0.0017	0.0016
Lot III . . . 0.0018 . . . 5	0.0016	0.0021	0.0021	—	0.0021
Lot IV . . . 0.0022 . . . 6	0.0021	0.0027	0.0026	0.0027	0.0024
Lot V . . . 0.0030 . . . 7	0.0028	0.0043	0.0062	0.0036	0.0036
Lot VI . . . 0.0112 . . . 8	0.0058	0.0072	0.0146	0.0094	0.0043
Lot VII . . . 0.0138 . . . { 9	—	0.0249	—	—	0.0108
	10	0.0083	0.0242	0.0220	0.0101
Lot VIII . . . 0.0347 . . . { 11	—	0.0317	0.0317	—	0.0180
	12	0.0250	0.0314	0.0311	0.0188

The prussic acid content of the seed of the descendants obtained at each of these stations was determined by the method already given. The results are given in the above table together with those found for the parent plants of which lots I-II (poor in HCN) and VII-VIII (rich in HCN) had been di-

vided into two, the first with mottled seed, the second with uniformly brown seed; both these groups had been sown separately to determine whether any correlation existed between the difference in colour and the prussic acid content.

From this table it is seen that, in spite of the great differences in the climate and soil of the three stations, the seed with a low and that with a high prussic acid content always produced descendants poor or rich in prussic acid respectively.

CONCLUSIONS: — In spite of variation caused by climate and soil the prussic acid content of the "Pe-gya" bean is an inherited character which remains fairly constant in the descendants.

There is no correlation between the colour of the seed and its prussic acid content.

The best "Pe-gya" beans grown in Burma so far still contain a little prussic acid, but only half the amount found in the beans imported from Madagascar to solve the problem of decreasing this toxic principle.

**1228 - Behaviour of the Hybrids of the Two Varieties of Peas "Siroendo" and "Sans Parchemin très large Cosse"; Experiments in Japan.** — SIGEROKU, N., in *The Botanical Magazine*, Vol. XXXII, No. 377, pp. 91-102 + 2 Plgs. Tokyo, May, 1918.

The Japanese pea "Siroendo" and VILMORIN'S "Sans parchemin très large cosse" pea both have edible pods which have not the parchment-like lining common in many other varieties of peas with unedible pods. By crossing these varieties the author obtained in the  $F_1$  hybrids of a totally different character from the parents, namely with hard, parchment-like pods which did not wilt when ripe but kept their stiffness and opened when twisted.

This rather rare phenomenon suggests the presence of two complementary factors which, being separated in the parents, have no effect, but when united in the hybrid cause the parchment-like thickening of the pods.

Should this be really so plants with stiff pods and others with soft pods in the ratio 9 : 7 should be found in  $F_2$ . An analysis of 622  $F_2$  plants showed there to be 339 with hard pods and 283 with soft pods. The theoretical figures corresponding to the ratio 9 : 7 are 349.88 and 272.12 respectively. The agreement between the numbers found and those calculated is satisfactory, the deviation being  $\pm 10.88$  and the probable error  $\pm 12.37$ .

An analysis of several  $F_3$  plants showed:—

1)  $F_2$  plants with soft pods produced exclusively plants with soft pods in the  $F_3$ .

2) Of the  $F_2$  plants with hard pods only some gave in  $F_3$  descendants with hard pods (Group A), whereas the others gave a progeny of mixed plants, some having hard pods and some soft pods amongst which may be distinguished group B (with ratio of the two types equal to 9 : 7) and Group C (with ratio equal to 3 : 1). Numerous analyses showed the three groups A, B and C to be in the ratio 1 : 4 : 4 as is seen from the following data:—

Number of $F_2$ plants with hard pods	Descendants in $F_3$	
68 . . . . .	Homozygous (with hard pods) . . . . .	7 of group A
	Heterozygous . . . . .	61 { 33 of group B 28 of group C

All these facts may be accounted for if it be admitted that the thickening of the pod is due to two factors separated in each of the parents, the factor **L**, producing the parchment-like tissue but unable to exercise this action except in the presence of **D**, which acts as a developer. The results of the cross might be formulated as follows:—

$P$ (parents)	<b>LLdd + DDll</b>	
$F_1$ (1st generation of hybrids)	<b>DLLl</b>	
	<b>DDLL + 2DDLl + 2DdLL + 4DdLl</b>	(1)
$F_2$ (2nd generation of hybrids)	<b>DDll + LLdd + ddll</b>	(2)
	<b>2Ddll + 2Lddl</b>	(3)

By a study of the gametic formula of the  $F_2$  it is possible to determine in advance the composition of the  $F_3$ . The seven combinations of (2) and (3) represent individuals with a single factor which, in the following generation, will give descendants with soft (unthickened) pods. On the other hand, of the nine combinations of (1) only the first **DDLL** will give homozygous descendants composed exclusively of plants with parchment-like pods, whereas the others will produce mixed descendants in the ratio 9:7 and 3:1, as is seen from the following diagram:—

<b>DDLL</b>	with homozygous descendants
<b>DDll</b>	
<b>DdLL</b>	{ with mixed descendants in the ratio 3:1
<b>DdLl</b>	
<b>ddLL</b>	
<b>ddLl</b>	9:7

These formulae and figures agree perfectly with the data obtained by analysing  $F_2$  and  $F_3$  and confirm the author's hypothesis of the existence of two complementary factors, the fusion of which causes thickening of the pods.

CEREAL  
AND PULSE  
CROPS

1229 - **Alternate Wheats.**— DE VILMORIN, J., in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 2, 16 pp. Paris, January 8, 1918.

"Alternate wheats" are wheats which may be sown alternately in autumn or spring as opposed to purely spring wheat, such as March chiddam, which cannot be sown in autumn. Wheats which may be considered alternate are:—

1) WHEATS WHICH BE SOWN THROUGHOUT MARCH:—

**Blé des Alliés.** — Grain sown at the end of February may ripen at the same time as winter wheat. Very fine, white grain. Does well sown in March in the north and centre of France.

**Blé seigle.** — Does well in very light soils which appear unsuited to rye.

*Amidonnier blanc*. — Suitable to cold, mountainous soils and does well where other wheats do not yield at all. Grows remarkably quickly. Yield not large.

*Blé de Noé*. — Suitable to any average good soil so long as it is healthy. Subject to rust. Does well in the south.

*Barbu à gros grain*. — Also does well in the south.

*Saumur de printemps*. — Grown in the plain of Caen.

2) WHEATS WHICH MUST BE SOWN BEFORE MARCH 15 AT THE LATEST:—

*Bordeaux*. — Does well in clay or vegetable soils as well as calcareous subsoils. Is most common in the South-West. In the West and Centre it covers half the area under wheat.

*Japhet*. — Does very well in February and often in March. Is suitable for sowing in spring where winter wheat has failed through frost. Much grown in Normandy.

*Hérisson sans barbes*. — Very resistant to heat.

3) WHEATS WHICH MAY BE SOWN IN FEBRUARY:—

*Inversible*. — Very early; adapted to the rich soils of the Centre and North. Is being grown more and more in France. Is particularly popular in Lombardy.

*Dattel*. — Is sown in February in the Pas-de-Calais and Somme departments. Ears a little late but gives a good yield regularly.

*Gros bleu*. — Does well in all soils; one of the most widely grown varieties.

*Touzelles rouge de Provence*. — Should be confined to the South as it is affected by cold. In healthy, calcareous soils in Provence and Languedoc it gives large yields.

*Rouge de Saint-Laud*. — A little sensitive to cold. Good variety for the West.

*Richelle blanche de Naples*. — For the south, and south-west districts and the calcareous soils of Berry. Slightly sensitive to cold.

*Richelle blanche hâtive*. — Excellent for the warm climates of the South and Algeria.

*Blé de Gironde*. — Beardless wheat. Tillers little but is very resistant to rust and smut. An excellent wheat for calcareous soils but very sensitive to cold.

Of the bearded wheats may be mentioned:—

*Rouge prolifique barbu*. — For the South. Adapts itself to any soil.

*Rieti*. — Gives good results in good soils and even in the medium soils of the centre.

*Pétanielle blanche de Nice*. — Variety for the South, for rich, and preferably calcareous, soils.

Finally, with certain reserve, *Bon Fermier*. — An excellent, very widely grown wheat. It is often planted in February and commonly does well in spring, but its success at this season is not absolutely assured.

1230 — **Manitoba Wheat in 1918, in Algeria.** — TRABUT, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 28, pp. 38-39. Montpellier, July 14, 1918.

Manitoba wheat has given good results this year in Algeria. Its resist-

ance to rust was remarkable, not one smutty ear was found in the experimental crops of the Botanical Station, the ears were longer than in the previous year, and the grain very fine. The seed received contained several varieties which it was necessary to separate and cultivate separately. At first sight five different varieties may be easily distinguished :—

1) *Manitoba A.* — White, more or less long ears with only a few short awns at the tip and three or four abortive spikelets at the base. This form is very similar to Marquis wheat, but behaved differently in summer cultural experiments. Marquis wheat, sown on July 15, 1917, gave a crop in October; it adapted itself well to irrigation and might be cultivated with maize. Manitoba wheat, under the same conditions, grew, but only gave a few thin ears.

2) *Manitoba B.* — Is distinguished by longer ears free from abortive spikelets at the base of the ear.

3) *Fife.* — Similar ear but red; probably one of the ancestors of Manitoba.

4) *Huron.* — Long white, bearded ear.

5) *Beardless hard wheat.* — Short, close ear. This hard wheat is of good quality but can only be judged when it has been isolated and grown on a large scale under varying conditions and compared with the native wheats. At first sight it appears to be a hard wheat suitable for dry countries and late sowing. It is a spring hard wheat. It is not very common in cultivated Manitoba wheat and the ears should be sought for and cut before the harvest.

FORAGE CROPS,  
MEADOWS  
AND PASTURES

1231 — **Rhodes Grass (*Chloris Gayana*) at Cuba.** — GOODMAN, D. S. and CENTURION, M. A., in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No. 1, pp. 17-18, + 1 Fig Havana, January, 1918.

Mr. Goodman, of the Chamaguey Agricultural Station, and Mr. Cunliffe of the Santiago de las Vegas Station, grew Rhodes grass experimentally. The former found it entirely satisfactory, giving a high yield, being easily made into hay and accepted by live-stock without difficulty. The latter found it suitable to poor, light soils, and one of the most productive fodder plants during the dry season (but less so during the wet season). Sowing in July in poor soil gives, in January, about 1.2 tons per acre and, eight months later 1.6 tons per acre. The hay is excellent and keeps well.

FIBRE CROPS

1232 — **Cotton Growing in Venezuela.** — HENRY, F. A., in *Commerce Reports*, No. 193, pp. 642-643. Washington, D. C., August 17, 1918.

It is stated that the cultivation of cotton has been regularly carried on in Venezuela since the American Civil War. During the last 20 years the domestic cotton-manufacturing industry has developed considerably, and in spite of an import duty of 3.43 cents per lb. on raw cotton, the industries have frequently been obliged to import it from the United States.

The chief cotton-growing regions are near Valencia and also farther in the interior in the State of Portuguesa. It is also being grown near Barquisimeto, Coro, and in other localities. The high prices that have prevailed for the past two years for cotton and cotton goods have given



a great stimulus to cotton growing. The Government has aided in this movement by the distribution of seeds. The only figures the writer has available showing the quantity raised are the following, which are stated in metric tons (of 2 204.6 lb.) transported by the "Gran Ferrocarril de Venezuela". States of Aragua and Carabobo:— 1906, 254 tons; 1912, 3 002 tons; 1915, 1 140 tons; 1916, 1 223 tons; and 1917, 1 931 tons; the production in the State of Portuguesa for 1916 was 605 tons, and in 1917, 1 944 tons. These figures probably represent seed cotton and do not by any means include the entire production of Venezuela or even of the consular district of Puerto Cabello.

Official reports predict a bright future for the industry. The locusts have proved very disastrous at times and were largely responsible for the drop in production in the Aragua-Carabobo region from 1912 to 1915. It is thought that the climate and soil of Venezuela are better suited to the growing of "Upland" varieties of cotton than "Sea Island" or "Egyptian".

**1233 - The Production of Flax in Italy.**— *Ingegneria Italiana*, Vol II, No 35, p. 103. Rome, August 22, 1918.

Flax production in Italy has been rapidly decreasing during the last twenty years as a result of the ever-increasing competition with imported cotton. Whereas the production in 1895 was 392 000 cwt. of fibre, in 1913 it was only 39 000 cwt. In that year the Italian flax industry imported 39 000 cwt. of raw flax, mostly from Russia, 3 900 cwt. of carded flax and 78 400 cwt. of flax thread, chiefly from Belgium. The Italian flax industry consists preeminently of weaving. More than three-quarters of the raw material used are imported. The most important centres of production are Lombardy, Campania, Calabria, and the Abruzzi, which together supply about 75 % of the total national production. In the five-year periods 1870-1874, 1879-1883, 1890-1894 and the three years 1911-1913, the average annual area under flax and the amount of fibre were 200 445 acres, 453 318 cwt.; 168 854 acres, 389 508 cwt.; 129 883 acres, 381 270 cwt.; and 21 698 acres and 51 334 cwt. respectively.

**1234 - Experimental Cultivation of Jute (*Corchorus olitorius*), "Malva" (*Urena lobata*) (1), and Sunn Hemp (*Crotalaria juncea*) in Cuba.**— GIRAUDIER, A, in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No 1, pp. 5-7 + 5 Figs Havana, January, 1918.

The sugar industry of Cuba uses 25 million sacks annually. The author was entrusted with the task of studying the possibility of making these sacks in the country. He brought from India seed of jute (*Corchorus olitorius*), "malva" (*Urena lobata*) and Sunn hemp (*Crotalaria juncea*) which he sowed and cultivated in different parts of the island, obtaining perfectly satisfactory results. If, however, these plants are to be grown on a large scale and compete with the Hindoo production, it is essential that prepa-

(1) *Urena lobata* = "paka" or Madagascar Jute (Madagascar) (See R., Oct., 1917, No. 919) "piri-piri" (Guiana, Haiti) = "bun-vehra" (India). (Ed.)

ration of the soil and fibre be done by machinery. The author himself has invented a machine for removing the fibre.

CROPS  
YIELDING  
OILS, DYES  
AND TANNINS

1235 - Experiments in the Growing and Manuring of Coconuts in Ceylon. — *The Tropical Agriculturist*, Vol. L, No. 4, pp. 209-213 + 5 Tables + 2 Diagrams. Peradeniya, Ceylon, April, 1918.

The Committee of Agricultural Experiments of the Ceylon Agricultural Society publish the results of experiments in coconut growing carried out from 1915 to 1917 at Chilaw and Pitiakande. These results are summarised in the two appended tables:—

TABLE I. — *Results of experiments at Chilaw.*

Plot	No. of palms	Treatment	1915		1916		1917	
			Number of coconuts		Number of coconuts		Number of coconuts	
			per plot	per palm	per plot	per palm	per plot	per palm
1	47	Clean weeded . . . . .	1931	41.1	2677	57.0	3262	69.2
2	72	Sulphate of ammonia 2 $\frac{1}{2}$ lb. per palm, 1915. Disk harrowed monthly, 1916, 1917 . . . . .	2804	38.9	4810	66.8	5267	73.1
3	89	Groundnut cake 6 lb. per palm, 1915. Crushed fish 6 lb. per palm, 1916, 1917. . . . .	3581	40.2	5014	56.3	5217	58.6
4	81	Steamed bone meal 8 lb. per palm, 1915, 1916, 1917. . . . .	4429	54.7	5800	71.6	5648	69.7
5	84	Sulphate of potash 2 $\frac{3}{4}$ lb. per palm, 1915, 1916, 1917. . . . .	3542	42.2	5225	62.2	5690	67.7
6	78	Ammonium sulphate 4 lb. per palm, 1915, 1916, 1917 . . . . .	3829	49.0	4074	52.2	5114	65.5
7	92	Mineral mixture 6 lb. per palm, 1915, 1916, 1917 . . . . .	3304	35.9	4714	51.2	5585	60.7
8	68	Lime 10 tons per acre, 1916 1917 . . . . .	2674	39.3	3306	48.6	4057	59.6
9	85	Mixed manure 10 lb. per palm, 1915, 1916, 1917 . . . . .	3383	39.8	4499	52.9	5464	64.2
10	107	Mulched with husks in 1915, no treatment . . . . .	2933	27.4	4616	43.1	4576	42.7
11	100	Mulched with husks in rings round palm . . . . .	2861	28.6	4286	42.9	3713	37.1
12	101	Ploughed . . . . .	2936	29.1	4691	46.4	3772	37.3
13	99	Ploughed and disked, 1917. . . . .	1859	18.7	3694	37.3	3384	34.1
14	76	Dug with "mamaty" (large hoe) and mulched with leaves . . . . .	2338	18.4	2294	50.0	2054	44.6
15	81	Watered. . . . .	—	—	3087	38.1	2094	25.8
16	59	No treatment . . . . .	2373	40.2	3222	54.6	3055	51.7

NOTES. — The soil of plots Nos. 11, 12, 13 and 14 is sandy. Plot No. 15 requires more than irrigation. Mulching round the palm is insufficient unless the soil is tilled yearly and then mulched.

The results show improved yields on half the experiment plots; the most satisfactory yields were obtained on plot No. 2. Liming plot No. 8

gave satisfactory results ; it was decided to reduce the amount of lime to 10 cwt. in the future.

TABLE 11. — *Results of experiments at Pitiakande.*

Plot	First treatment	Treatment in 1917	Number of coconuts per tree			
			1914	1915	1916	1917
1	Estate mixture . . . . .	No manuring . . . . .	64	103	76	71
2	Lime . . . . .	Lime broad-casted . . . . .	59	96	76	84
3	Ploughed twice yearly . . . . .	Ploughed with village plough . . . . .	37	68	55	76
4	Soil stirred monthly . . . . .	Clean weeded and soil stirred . . . . .	28	54	64	86
5	Cattle tied . . . . .	Cattle tied to trees . . . . .	44	55	71	77
6	Control (in grass) . . . . .	Control (kept in grass) . . . . .	43	48	40	42
7	Nitrogenous and potassic manure without phosphoric acid . . . . .	No manure . . . . .	49	59	53	59
8	Mineral mixture . . . . .	No manure . . . . .	49	55	55	49
9	Organic mixture . . . . .	No manure . . . . .	30	37	37	56
10	Control . . . . .	Control (no <i>Tephrosia</i> planted) . . . . .	27	34	30	28
11	Nitrogenous and phosphatic manure without potash . . . . .	No manure . . . . .	53	38	37	55

NOTES. — Weather conditions have a great effect. Plots 4 and 5 gave increasing yields from the beginning in spite of the weather conditions. The value of stirring the soil and of manure is clearly shown. Besides these results two tables are given, one of the yields obtained in experiments at Maha Iluppalama, the other of measurements of the development of leaves and trees made at Negombo from 1914 to 1917.

1236 — *The Properties and Botanical Origin of "Cu-nâu"*. — CHEVALIER, A., in the *Bulletin économique de l'Indochine*, Year XXI, No. 130, pp. 325-330. Hanoi-Haiphong, May-June, 1918.

The products known as "Cu-nâu" are of great commercial and industrial importance in Tonkin. The name is given to sub-spherical or oblong woody tubers varying in size from that of a fist to that of a head. They are rich in tannin and colouring matter somewhat resembling catechu and gambier or rather the dye obtained from mangroves of the genus *Cerriops*. These tubers are found in the forests of almost the whole of Tonkin and North Annam. In addition to those used for local consumption 5 000 to 8 000 metric tons are exported annually, chiefly to China.

In the Far East Cu-nâu is used exclusively for dyeing, especially for fishing nets. A cheap khaki dye, for dyeing coolies' clothes is also made from it. The tuber is soaked in water, grated, and left several days to ferment. To obtain a black colour the dyed material is buried in the bad-smelling mud at the bottom of ponds; the colour turns black but is not fast.

An analysis made by M. E. Rosé (Director of the Chemical Laboratory of the Pasteur Institute of Saigon) at the request of the Supplies Service,

gave the following results : tannins (CAFERNI method modified by SISLEY) 7.6 % of the tubers ; soluble non-tannin 5.4 % of the tubers ; insoluble non-tannin 6.8 % ; total residue taken up by water 19.8 %. The Cu-nâu tuber, therefore, contains an amount of tannin similar to that contained in the bark of oak (6.8 to 13.6 %).

The Cu-nâu tuber is collected throughout the year in the forests of the middle and high districts of Tonkin. The retail price is about \$0.40 per 30 kg. and the wholesale price about \$1 per 100 kg. In the Delta the prices have already doubled as a result of transport expenses and middlemen's fees. The quantity exported represents only a small proportion of the production, the full amount of which is unknown, as much of it evades the verifications of the forestry agents.

There are several varieties of Cu-nâu, some belonging to the genus *Dioscorea*, others to the genus *Smilax* (Liliaceae). A description is given of different varieties examined locally by the author during his forestry tours of 1917-1918 (made to draw up an inventory of the forestry resources of Indo-China) with their names in the different dialects of Indo-China. The author does not consider it advisable to make Cu-nâu plantations for root production, but it would be useful to start small plantations for producing seed with which to re-plant the Cu-nâu forests which are disappearing. The Forestry Service should make controlled forest reserves of Cu-nâu to be exploited rationally in due course.

M. PH. EBERHARDT (1) has already pointed out the use to which Cu-nâu might be put in Europe as a substitute for catechu. After showing that Cu-nâu partly loses its colouring power on drying he suggests the local preparation of a concentrated extract by infusion followed by evaporation. The author agrees that this would be the best method of utilising this product. Should it be used for tanning, as advised by M. E. ROSÉ, it would have to be exported either in dried slices or as a solid extract similar to that prepared in Borneo from mangrove bark.

RUBBER,  
GUM AND RESIN  
PLANTS.

1237 - **The Utilisation of Colonial Rubber.** — Communication from the Institut Colonial of Marseilles, presented by M. LOUIS-DOP, Delegate of France, Vice-President of the International Institute of Agriculture.

At the request of M. LEPLAE, Director General of Agriculture of the Belgian Congo, the Belgian Colonial Ministry has commissioned M. G. VAN PELT, attached to the Government of the Belgian Congo, to cooperate with the Institut Colonial of Marseilles in a study of the preparation and conditioning of rubber. After having assisted in the investigations of the Rubber Laboratory of Delft, M. VAN PELT directed the technical work of one of the largest rubber plantations of Sumatra. The Institut Colonial of Marseilles intends to study first of all the measures to be taken so that African rubber may profit by the technical progress which has been made in the preparation of rubber.

The "Cahiers Coloniaux" of October 18, 1918, published by the Institut

(1) PH. EBERHARDT, *Les matières premières végétales et animales de l'Annam*, Hanoi, 1917, p. 66. (Author)

Colonial of Marseilles, contain a report on this subject by M. VAN PELT, and another one by M. E. BAILLARD, Secretary-general of the Institut Colonial on the measures now proposed for supplying France with rubber. Extracts from the resolutions of the Office established in French Guinea to prevent fraud in exporting rubber from this country, from the Syndicate of Planters of Indo-China and the Professional Rubber Syndicate, complete this paper on the attempts made, with the active cooperation of the "Comité du Caoutchouc" of the Production Organisation Service of the Ministry of Armaments, to use colonial rubber to the best advantage.

**1238 - The Effect of Light in Healing Rubber-Tree Wounds.** — *India Rubber World*, Vol. LVII, No. 5, p. 310. New York, February, 1918.

Experiments on the effect of light on the healing of tapping wounds were recently made by HARMSEN on four year old trees of equal dimensions. From each tree a strip of bark and cambium (from 1 to 5 cm.) was removed at a height of 1.5 metres and the wound covered with blue, green, yellow, orange and colourless glass. Blue and colourless glass gave the best results, yellow the worst. Uncovered wounds healed more slowly than those covered with coloured glass, which, in their turn, healed more slowly than those covered with colourless glass.

**1239 - New Varieties of Sugar Cane Produced at Porto Rico.** — COWGILL, H. B. (Experiment Station of Río Piedras), in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 114-118. San Juan, 1918.

SUGAR CROPS

At Java, in the British Antilles, Barbadoes and British Guiana, new varieties of sugar are produced each year in order to obtain a cheaper product capable of competing with beet sugar. At Porto-Rico it is also necessary to eliminate the poor and degenerate varieties. Seed is selected throughout the island. The Experiment Station of Río Piedras collected as many local varieties as possible and then crossed them. The hybrids were subjected to comparative tests first at the Station itself, then in other experimental centres and by growers. This work, though still in progress, has already given excellent results.

There are four prominent new varieties — B-3412, Sealy Seedling, D-117, B-376. The first gives a large yield, its juice is of average purity and sugar content, and it is specially suited to the hills of the southern coast of the island. The same may be said of the second. The third is better suited than the others to low land, in which it produces much thicker cane. So far the fourth has been tested only at the Río Piedras Station, where it has given excellent results. Other varieties worthy of mention are B-208 for cool, rich soil, in which it surpasses the others in sugar content, but is very subject to injury from drought, D-109, B-3405, etc.

Among the varieties to be eliminated are mentioned:— Otahitú or Caña blanca of the Río Piedras district, where it yields little and is subject to disease (it grows well in the rich fields of the south coast), dura roja or Cavengerie, Yellow Bamboo, Morada, and Pinang.

The work on disease-resistant sugar cane has not yet given absolutely

immune varieties. Those which have proved most promising in the comparative experiments are : — B-4596, B-3412, D-117, Caldonia Amarilla.

**1240 — The Cultivation of Sugar-Cane in Persia.** — CALDWELL, J. L., in *Commerce Reports*, No. 129, p. 858. Washington, D. C., June 3, 1918.

It is believed that the cultivation of sugar-cane was formerly more important in the Province of Mazanderan than at present, for it appears to have been abandoned on account of the difficulty in extracting the juice. Cane is cultivated at present around the edges of cotton fields, but it could doubtless be cultivated profitably on a large scale on suitable soil. The zone of cultivation is found in the rectangle formed by the Caspian Sea and a parallel line passing Amol, Barfaruche, and Sari.

Since the beginning of the war, the price of sugar having greatly advanced, the cultivation has again been taken up. It is estimated that the 1917 harvest totaled about 120 000 Tabrizi batmans (1 560 000 pounds), of which Mazanderan consumed about half; 10 000 batmans were sent to Teheran and 50 000 batmans were transported in coasting ships to Enzeli, Chassovar, etc.

Two kinds of sugar-cane are grown in the Province :— a) The "Indi Lale" (the seeds of which are planted), which produces a sirup about the thickness of molasses of grapes, and b) "Sheker Lale" (of which the shoots are planted), yields a moist sugar which can be solidified.

Sugar-cane is planted in the spring and must be harvested in the autumn before it is cold enough for frost. The fields must be well tilled, and much moisture is necessary as in dry years good crops are not obtained.

When the crop has been cut it is stacked on the ground; near by a hut is erected for cooking the juice. Four oxen are needed for crushing the cane. The juice is boiled during the night and about 50 mans (300 pounds) of dry reeds are used as fuel in one night. The process necessitates the presence of at least four persons. When done, the sugar is poured into moulds and removed as soon as it is cold. The production is about 1 600 pounds per acre.

Before the war 12 kharvars (8 000 pounds) of moist sugar cost about 100 tomans (at normal rates of exchange 1 toman is slightly less than \$ 1) to produce and could be sold for about 120 tomans. Therefore, with such small profits, peasants could plant only around the edges of fields or in small quantities. At present the cane can be cultivated in large quantities, for while the expenses of production amount to about 120 tomans for 12 kharvars, that amount can now be sold for 240 tomans or even more. Moist sugar is worth at least twice as much as the sirup from "Indi Lale".

**1141 — Yellow Sugar Cane ("Mia-vang"), Red Cane ("Mia-ly") and Small Cane ("Mia-lau"), Varieties Grown in Indo-China.** — See 1190 of this Review.

**1142 — Future of the Yemen Coffee Trade.** — In *The Board of Trade Journal*, Vol. C, No. 1113, pp. 381-382 (380-382). London, 1918.

Coffee is the main product of Yemen agriculture and in 1909 there was a substantial increase in the value of this export as compared with the pre-

STIMULANT,  
AROMATIC,  
NARCOTIC AND  
MEDICINAL  
PLANTS

vious four years; but since the rain shortage throughout the Yemen highlands in the summer of 1910 there has been a great falling off in both quality and quantity, for many growers never emerged from the financial straits in which they were then involved. The following figures for 1909 show the normal movements of exported coffee:—

Markets.	Tons.	£.
French (chiefly Marseilles), . . . . .	1 849	112 995
United States (New York and Boston) . . . .	836	51 000
Egypt . . . . .	908	56 225
Aden (for reexport) . . . . .	372	22 750
London . . . . .	242	14 800

The various grades of Yemen coffee are named after the district of production. Harrazi coffee heads the market for quantity and general average of quality. The highest grades are Matari and Anisi, which are noted for the hardness and regularity of the beans; if stored too long at Hodeidah or elsewhere on the coast, where the air is invariably damp, the bean of both these grades is apt to whiten at the ends, which infallibly denotes deterioration to the practiced buyer; the Anisi bean is pale yellow, and very hard; it stores better than the Matari. The districts of Heimah and Reimah may be bracketed for yield and quality; the bean is somewhat irregular. Coffee from Mount Bura heads the lower grades, and is noted for the reddish tinge of the bean, which it loses if stored too long in the damp atmosphere of Hodeidah. The yield from J. Molhan is considered generally inferior to all other grades. The vague term Sherqi, or eastern, covers a large tract of country, and includes various grades; an average quality ranks in the market with the best from J. Reimah. Most of the Taizi coffee (S. Yemen) is imported via Aden. It should be noted also that the standard quality in the various districts may vary from year to year, owing to irregular harvesting, which is traceable to financial pressure on growers, or to political disturbances. Large tracts of coffee have been destroyed in disturbed areas.

1243 — **Tea in Indo-China.** — EBERHARDT, P., in the *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Hanoi Series, No. 9, 18 pp. + 1 Plate. Hanoi-Haiphong, 1918.

The species cultivated throughout Indo-China is the *Thea chinensis* Sims. (*T. sinensis* Linné), but there are many varieties. This may be explained by the variety of soils in which the crop is grown, as well as by differences in latitude and, consequently, weather conditions, which influence the development of the species (between 8° and 25° northern latitude.)

PIERRE describes five varieties of *Thea chinensis*. — *Bohea*, *viridis*, *pubescens*, *cantonensis* and *assamica*. The author (temporary Chief of the Economic Service of the General Government of Indo-China) believes there are

others, but this can only be decided by a close botanical study of cultivated and wild plants from the five parts of the Union. Samples should be collected all over Indo-China for this investigation, the result of which the author hopes to present to the Tea Congress to be held in Java in 1919.

**NATIVE CULTIVATION.** — The districts of Indo-China in which tea is most grown are, in order of importance, Tonkin, Annam and Cochinchina. Methods are very rudimentary everywhere. The greatest mistake the natives make is to plant tea in low land though the species prefers mountain districts. The slopes and table-lands of the Annam Chain, from north to south of the peninsula where the species grows wild, is admirably suited to this crop which would make all this mountain district more healthy.

The native's methods are the same everywhere. As he has not yet been persuaded to start nurseries he sows in the field, putting two or three seeds together in holes 23 to 32 inches apart. When germination is over only the strongest of the three plants is left, the other two being uprooted. Practically no care is given the plants, only weeding is practised and the great hardiness of the plant makes this sufficient. Neither pruning nor topping are carried out. Picking begins, as a rule, when the plant is three years old, and is generally so rough that the plant is entirely stripped of its leaves; this occurs several times a year.

The prices of the dried leaves vary so considerably that they cannot be attributed only to differences in the subsoil and must be due to different species or varieties.

**EUROPEAN CULTIVATION.** — Crops are so far only grown by Europeans to a small extent. There are barely 500 000 to 600 000 tea bushes in the European plantations of Tonkin and 200 000 in those of Annam. Every thing remains to be done and the Agricultural Services should appoint specialists capable of directing the development of European cultivation.

The native has not attempted to improve the cultivation of tea because, apart from the rich class who obtain their tea from China, the Annamite wishes to obtain qualities which to us are defects; he wants a very strong drink, his palate being burnt by lime and betel, and one which will enable him to shake off fatigue. Tannin, then, a glucoside, an essential oil, and an albuminoid (combined with the tannin), give the tea properties which are attenuated by industrial preparation and increase with the age of the leaf. The native picks the full-grown leaf and drinks an extract of green or simply dried tea.

**PREPARATION.** — There is only one establishment in Tonkin and two in Annam for preparing the leaves for export to France. The tea preparation industry has, therefore, yet to be created in Indo-China. This, however, can only be done when tea growing is definitely established on a rational basis and it has been possible to show the quality of Indo Chinese teas.

**WILD TEA** — Apart from the formation of plantations attention should be given to the improvement of the wild species, abundant in the mountain chain which crosses the peninsula, with a view to the production of them.

The author reported for the first time in 1907 the existence of wild tea plants in the Tamdav Range, Tonkin. He has since found this plant in



different parts of Upper Tonkin and in the whole Annam Chain (North and Central Annam). According to recent information the tea drunk by the natives of Laos is obtained exclusively from wild plants, with the exception of the tea from China consumed by the rich classes. There appear to be two species of these plants :— 1) the “ Mieng-luang ”, very common in the basins of the Nam-sang and Nam-bon (Muong of Vientiane), in the Tasseng of Natho (Vango-vieng), as well as in the Tourakhom district ; it is a forest variety but has become acclimatised well on the banks of the Honei, 2) the “ Mieng-noi ” or “ Mieng-kay ”, less common, and found almost exclusively in high districts and forests ; it grows largely in the Muong of Vang-vieng and of Borikhane, but little in the Muong of Vientiane.

TEA TRADE. — The details of the Indo-Chinese tea imports and exports are given in table form. Annam is by far the largest exporter. In 1916 Indo-China exported 918 metric tons of tea, of which 888 went to France ; 811 tons of this quantity were exported by Annam alone. In 1911 the exports were 559 metric tons (487 tons for Annam), of which 564 tons were sent to France. Indo-China imports tea from China (especially from Hong-Kong) and India. In 1915 the imports amounted to 970 metric tons, in 1916 to 903.

*Analyses of different varieties* of tea prepared by the native and by the French methods are given. The analyses were made by M. AUFRAY, Director of the Agricultural Laboratory of the Institute of Hygiene and Bacteriology at Tonkin. The teas analysed were :—

1) Teas prepared by native methods :— tea from Trâu-ninh, moc tea of 1st, 2nd, and 3rd quality, Chê-Lu, Tuyét-lu, Man-thang, Vân-trân, Chê-tuoi, Chê-tuyêt, Chê-ta, Chê-bang, Bac-quang, Chê-tu, êt Ha-giang, Tuyêt-thai, Chê-thai.

2) Tea prepared by French methods : — Chaffanjon tea.

The analyses show Tonkin teas to be poorer in tannin and alkaloid than those of Annam, which are the richest in the world in their. They could, therefore, be grown advantageously (especially the wild species) for extracting this alkaloid. The analyses also show Tonkin teas to resemble Chinese teas in their tannin and alkaloid content. They, however, differ greatly in composition, so that they should not be prepared by the methods adopted in India and China. Great attention should be given to the chemical reactions so as to find the critical point which determines their quality, especially with respect to the fermentation.

It must not be forgotten that the commercial preparation of Indo-Chinese teas is closely connected with the existence of rationally conducted plantations. Great progress has already been made in this direction. The natives supplying European firms have been persuaded to bring young leaves which resemble much more those treated in Ceylon and China, instead of old ones.

The quality of Indo-Chinese teas has been tested by experts several times. M. C. A. GUIGNON and M. DIJANNET have shown certain commercial varieties of Annam tea to be excellent. It would be easy to aromatise the tea artificially as is done by the Chinese as all the floral species they

use for this purpose are found in the colony (*Jasminum Sambac*, *Olea fragrans*, *Aglaria odorata*, lotus pollen, etc.).

All efforts should be directed to the rational and commercial production of Indo-Chinese tea. Such an enterprise should capture rapidly the French market, which hardly exceeds 1500 metric tons, and compete easily with the Ceylon and China teas at present used :—

1) by supplying a superior quality, for the excessive tannin content of Ceylon tea absolutely ruins the intestinal mucosa and its astringency injures its flavour;

2) by producing qualities equal to the best Chinese teas, with the advantage of freedom from duties and less heavy freightage.

**1244 - Vanilla as a New Product of Porto Rico.** — McCLELLAND, T. B. (Assistant Horticulturist, Mayagüez Agricultural Station), in the *Revista de Agricultura de Puerto Rico*, Vol. I, Nos. 1-2, pp. 45-48. San Juan, April-May, 1918.

Although vanilla is exported in large quantities from Guadeloupe and Saint Domingo, islands near Porto Rico, it is hardly grown at all at Porto Rico itself. Nevertheless the existence in several localities (Bayamón, Dorado, Lares, Maricao, Mayagüez, San Germán, Guánica, and Guayanilla) of wild vanilla probably belonging to species of no economic value, shows that vanilla should do very well in this country. The author made cultural experiments with vanilla at the Mayagüez Agricultural Station and obtained good results. The pods were judged excellent in appearance, scent and flavour and sold at \$ 5 per pound.

**1245 - Saffron from Kosani, Greece.** — VALDIGNÉ, in the *Journal de Pharmacie et de Chimie*, Series 7, Vol. XVIII, pp. 183-184. Paris, September 16, 1918.

Saffron grows wild in Asia Minor, Persia, and in Greece where it is cultivated most in the Kosani region, to the S. S. W. of Macedonia, on a vast plain, 2330 ft. high, and where the thermometer does not go below 5°C. The species, *Crocus sativus*, the same as that grown in France and Spain (1) is characterised by having deeply dentate stigmas; the plant barely reaches 8 in. in height and is propagated by bulbs; once planted it lasts 7 or 8 years. The flower only lasts one or two days; as soon as it appears the styles and stigmas are gathered by children and spread on carpets with a long pile where they lose  $\frac{1}{4}$  of their weight. The reddish-yellow, more or less dark coloured stigmas are separated from the bright orange yellow styles; 100 lb. of crude saffron yields 60 lb. of red saffron and 40 lb. of yellow saffron; the latter, of no commercial value, serves for domestic purposes.

The red Kosani saffron is similar to the French Gatinais saffron; it has a strong pleasant smell and gives a fine dark-red powder; owing to its fineness it is very light. The price varies according to the supply and the quality; before the war it cost about 36s. a lb., the most esteemed being that with a light red brown colour. It is mostly sent to France where it is sold as Gatinais saffron.

(1) In Italy also, especially in the province of Aquila, which gives a good-quality product. (Ed.)

1246 — Govap Tobacco and Hoemon Tobacco, the Two Best Indo-Chinese Tobaccos for Native Consumption. — See No. 1190 of this Review.

1247 — Introduction of Cinchona into Madagascar. — LEGENDRE, J. in the *Bulletin du Muséum national d'Histoire naturelle*, Year 1916, No. 7. Paris.

The Colonisation Service planted cinchonas from seed from the Dutch Indies. Certain high districts of Madagascar appear suitable to cinchona growing which, if successful, might prove a source of income for the colony.

1248 — Some Useful Plants of Chili (1). — COSTES, in the *Bulletin de la Société nationale d'Acclimation*, Year LXV, No. 4, pp. 112-115. Paris, April, 1918.

VARIOUS CROPS

A list is given of the following useful plants of Chili :—

“Algarrobo” (*Prosopis Siliquastrum* Gay = *P. juliflora* D. C.). — A tree about 20 to 25 ft. high, growing from Coquimbo to the Cachapoa river. The pods are much liked by animals. The wood is a violet-brown, very hard and used by wheelwrights; it gives very good charcoal. The seed is much appreciated medicinally for cardiac troubles on account of the tannin it contains.

“Molle” (*Lilthraea molle* Gay = *Schinus latifolius* Engl.). — A bushy tree about 16 ft. high. Before the vine was introduced a fermented drink “chicha de molle”, was made from its fruit. The white resin, obtained by making incisions in the trunk, is much used for curing leucoma and for making poultices for blows, sprains, and muscular rheumatism. The bark extract is used for nervous diseases. Wood used by wheelwrights.

“Guayacan” (*Porlieria hygrometrica* Pav. = *P. hygrometra* R. and Pav.) — A bush growing in sandy soil or alluvion. The light yellow, very hard wood is used for making small articles (combs, spoons, knife handles, bearings, etc.). The wood contains much resin which is used as an emmenagogue, stimulant, diaphoretic, and balsamic. It is recommended for herpetic troubles, chronic rheumatism, chest troubles, and as a cure for blows, bruises, and syphilitic troubles.

“Alcaparra” (*Cassia vernicosa* Clos = *C. laevigata* Willd.). — A bush common in the central provinces. The wood is very hard, resistant, and almost immune to the effects of damp and, therefore, used as props for vines. The bark and fruit are used as astringents. The leaves are purgative and the extract made from them is used to cleanse the head and free it from parasites.

“Litre”. — An evergreen bush from 16 to 20 ft. high. In the rocky mountains or those with loamy soil it is stunted and the stem grows parallel with the soil. The wood is used by wheelwrights, is very hard, and makes excellent charcoal. The “litre” is recognised as dangerous as in some people the shade, smoke, wet leaves and sap cause swellings which become pustules. Dr. A. MURILLO believes the extract could be used like thapsia to resolve eruptions; resin and volatile oil.

(1) See R., May, 1916, No. 498. (Ed.)

FRUIT GROWING 1249 — **The Pollination of Fruit in Relation to Commercial Fruit Growing** (1). — HOOPER, C. H., in *The British Bee Journal*, Vol. XLVI, No. 1463, pp. 13-14; No. 1465, pp. 28-29; No. 1467, p. 45; No. 1470, p. 73; No. 1471, pp. 79-80; No. 1473, pp. 97-98. London, 1918.

The author gives the results of his investigations and experiments on the pollination of fruit trees, including apples, pears, plums, and cherries. Lists of the fertile, and self-sterile varieties of each of these fruits are given, as well as lists of the different varieties which should be planted together. Most of the cross-pollination, specially in the case of apples, is done by insects, particularly hive and humblebees.

**APPLES.** — *Fertile*: — Irish Peach, Golden Spire, Stirling Castle, White Transparent (occasionally), Lord Derby, Tower of Glamis, Duchess of Oldenburgh, Egremont Russet, Devonshire Quarrendon, Summer Golden Pippin, Christmas Pearmain, Dominc, Washington, Ben's Red, Red Reinette, Lord Grosvenor, Early Victoria, Ecklinville, Allington, King of the Pippins, Peasgood's Nonsuch, Pott's Seedling, Gladstone, Newton Wonder.

*Self-sterile*: — Astrachan, Ribston Pippin, Lord Suffield, Hoary Morning, Warner's King, Nonpareil, Striped Beefing, Sturmer Pippin, Fearn's Pippin, Belle de Pontoise, Duchess's Favourite, Bismarck, Cox's Orange, Beauty of Bath, Hambling's Seedling, King of Tompkin's, Beauty of Kent, Cellini, Worcester Pearmain, Seaton House, The Queen, Rival, Alfriston, Lady Sudeley, Loddington, Blenheim Orange, Waltham Abbey, Prince Albert, Grenadier, Hollandbury, Lady Henneker, Cox's Pomona, Golden Noble, Annie Elizabeth, William's Favourite, Mère de Menage, Sandringham, Graham's Royal Jubilee.

*Varieties to plant together*: — Bismarck with Barnack's Beauty and Lord Derby; Warner's King and Cox's Orange; Cox's Orange Pippin with Worcester Pearmain, Duchess's Favourite, King of the Pippins and James Grieve; Beauty of Bath with Allington Pippin, Lane's Prince Albert, and Gladstone (but Gladstone does not crop well with Beauty of Bath); Bramley's Seedling with almost any variety, especially Cox's Orange, Lane's Prince Albert, Newton Wonder, and Grenadier; Lady Sudeley with Gladstone; James Grieve with Cox's Orange, Stirling Castle, King of the Pippins, and Blenheim Orange; Gladstone with Cox's Orange and Worcester Pearmain; Peasgood's Nonsuch with Wellington; Grenadier with Lane's Prince Albert and Early Victoria; Lord Derby, to some extent self-fertile, but improved by cross pollination, crops well with Graham's Royal Jubilee or Beauty of Bath; Lane's Prince Albert with Lord Derby, Stirling Castle, Grenadier, Beauty of Bath, Cox's Pomona, Bramley's Seedling and Allington Pippin; Annie Elizabeth with Warner's King; Newton Wonder with Prince Albert and Lord Derby; Worcester Pearmain with James Grieve; St. Edmund's Pippin with Ribston; Allington with Worcester Pearmain; Cox's Orange with Sturmer Pippin and Lord Grosvenor.

(1) See also *B.*, Jan., 1912, No. 83; *R.*, Febr., 1914, No. 133; *R.* Jan., 1916, No. 61; *R.*, June, 1917, No. 554; *R.*, June, 1918, No. 649. (*Ed.*)

**PEARS.** — *Slightly self-fertile*: — (In England) Conference, Durendeu, Duchesse d'Angoulême, Colmar d'Été, Hacon's Incomparable, Marguerite Marillat; (in America) Duchesse d'Angoulême, Beurré Bosc, Beurré Diel, Doyenné d'Alençon, Flemish Beauty, White Doyenné.

*Self-sterile*: — Beurré d'Amanlis, Beurré Superfin, Catillac, Emile d'Heyst, Jargonnette, Josephine de Malines, Louise Bonne of Jersey, Beurré Alexandre Lucas; Clapp's Favourite, Williams' Bon Chrétien, Olivier de Serres, Bellissime d'Hiver, Pitmaston Duchess, General Todleben, Winter Crisanne, Marie Louise, Dr. Jules Guyot, Beurré Diel, Citron des Carmes, Uvedale's St. Germain, St. Luke, Souvenir du Congrès.

*Varieties to plant together*: — Dr. Jules Guyot with Doyenné du Comice and Williams' Bon Chrétien; Williams' Bon Chrétien with Le Lectier, Winter Crisanne and Fertility in England, with Beurré d'Anjou and White Doyenné in U. S. A., with Bailey's Bergamot in Victoria, Australia; Pitmaston Duchess with Catillac, William's Bon Chrétien, and Louise Bonne of Jersey; Doyenné du Comice crops fairly well with Pitmaston Duchess, Conference and Fertility and well with Emile d'Heyst, Souvenir du Congrès and Glou Morceau; Clapp's Favourite with Josephine de Malines; it also fruits well among a mixture of pears.

**PLUMS.** — *Self-fertile*: — Victoria and Czar fruit nearly as well self-pollinated as cross-pollinated; Denniston's Superb, Monarch (but should not be planted alone), Early Favourite, Reine Claude Violette, Myrobella, Giant Prune, Early Transparent, Reine Claude de Bavay, Prince Englebert, Early Favourite, Gisborne, Oullin's Golden Gage, Golden Transparent, Pershore, Magnum Bonum (red and white), Kentish Bush, Warwickshire Droopers, Damsons.

*Nearly self-sterile*. — Rivers' Early Prolific, Mallard, Stint.

*Self-sterile*: — Histon Gage, Early Orleans, Sultan, Kirke's Blue, Coe's Golden Drop, Coe's Violet, Washington, Late Transparent, Ickworth Imperatrice, Early Greengage, Old Greengage, Reine Claude d'Altham, Wyedale, Grand Duke, Jefferson, Pond's Seedling, Curlew, Prune d'Agen, Bryanstone.

*Varieties to plant together*: — Coe's Golden Drop with Pond's Seedling, Early Rivers, Reine Claude Violette, Rivers' Early Prolific, Prune d'Agen, Monarch, Wyedale, Denniston's Superb, Early Mirabella and Reine Claude d'Altan, does best near several varieties of plums; Early Greengage and Old Greengage do not inter-pollinate but set well with pollen of Victoria and Pond's Seedling; Wyedale with Rivers' Early Greengage and Coe's Golden Drop; July Greengage with Old Greengage and Rivers' Early Prolific; Greengage with Egg plums, Early Orleans, Monarch, Pond's Seedling, Kentish Bush, Victoria, Czar, Rivers' Early Prolific; Rivers' Early Prolific with Egg plums, Early Orleans, Czar, Monarch, Prince of Wales, Pond's Seedling; Belle de Louvain with Prince of Wales, Duke, Victoria, Czar, Egg and Early Rivers; Pond's Seedling with Pershore plums and damsons; Washington with Pond's Seedling, Early Transparent with Late Transparent and *vice versa*; Reine Claude d'Altan with Coe's Violet, Coe's Golden Drop and Jefferson; Monarch with Rivers' Early Prolific.

**CHERRIES.** — *Self-fertile*: — Morello, Kentish Wye Morello and Late Duke.

*Self-sterile*: — Black Heart, Elton, White Heart, Kentish Early Rivers, Burg d'Aunay, Black Tartarian, Bigarreau Napolcon, Bigarreau Frogmore, Early Giugne d'Annonay, May Duke.

*Varieties to plant together*: — Elton with Early Frogmore; Black Heart with Morello; Early Rivers Black with Baumann's May, Goodenston Black, Turk, Elton, Knight's Black, Governor Wood, Coronne, Florence, Black Heart, Waterloo, Black Eagle, Amber Bigarreau, Old Kentish Black and Circassian; Elton Heart with Early Rivers, Montreuse de Mezel and Frogmore; Black Tartarian or Turk with Black Eagle, Napoleon, Elton, Amber Bigarreau, Knight's Early Black and Early Rivers; Kentish or Amber Bigarreau with Black Eagle, Turk, Elton, Frogmore, Waterloo, and Governor Wood; Waterloo Black with Circassian and Amber Bigarreau; Napoleon with May Duke, Webb's Black, Governor Wood, Waterloo, Amber Bigarreau, Morello and Frogmore, in California it does well with Black Tartarian, Black Bigarreau and Bing, and in Oregon with Deacon and Lambert; Governor Wood with Elton and Napoleon; Old Kentish Black may be self-fertile but fruits well with Elton, Early Rivers, and Turk; Black Eagle with Turk; Knight's Early Black with Black Eagle; Circassian with Old Kentish Black and Early Rivers; Florence with Napoleon and Early Rivers; Roundel with Amber Bigarreau.

**GOOSEBERRIES, CURRANTS, RASPBERRIES, LOGANBERRIES, AND STRAWBERRIES.** — In England all these set and mature fruit perfectly with pollen of the same plant or variety, though some of the strawberries grown in Canada and the United States need to be interplanted with another variety for cross pollination. Insects are absolutely necessary to pollinate gooseberries and white, red, and black currants. Raspberries and loganberries give only imperfect fruit if not pollinated by insects, and strawberries, though chiefly pollinated by the movement of the air, doubtless benefit by insect pollination.

**1250—Direct Bearers at the National School of Agriculture of Montpellier (Hérault France).** — RAVAZ, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 12, pp. 265-272. Montpellier, March 24, 1918.

In the School experiment field, in order to estimate with exactitude the value of each direct bearer, side by side with the new ones were placed old ones, such as Delaware, Othello, Autrichon, Canada, Secretary, Jacquez, Noah, Elvira, York-Madeira, Clinton, Herbemont, Telegraph.

**OLD HYBRIDS.** — *Delaware.* — This plant showed little resistance to mildew. Its foliage is very similar to that of *V. aestivalis*, from which it descends. The fruit is very ripe with a very pleasant flavour and would make excellent liquor. Unfortunately the smallness of the bunches excludes a high yield, nevertheless its cultivation might be attempted in districts where liqueurs are produced. It must be grafted as it is almost completely unresistant to phylloxera.

*Othello.* — Does less well than in the centre of France. Its resistance

to mildew is unsatisfactory but sufficient for the usual treatments to protect it.

*Secretary.* — No resistance to mildew.

*Jacquez.* — This was, as usual, much affected by mildew. Grafted on *Rupestris* it is exceedingly weak, but stronger ungrafted. It does not combine well with other stock, especially *V. rupestris* (suffers from thyllosis). As it is fairly resistant to phylloxera it must be planted ungrafted if the soil is of sufficiently good quality. Some of its varieties are better grafted:— *Jacquez-Marignan* (always very fine on *Rupestris*) and *Jacquez-Dauty*.

*Noah.* — Not immune to mildew, but sufficiently so and, in practice, may be grown without treatment; only in wet springs is it advisable to spray the bunches. Ungrafted it is rather weak at the School as it is subject to chlorosis and the soil is very calcarèous.

*Clinton* (Plant Pouzain or Plant des Carmes). — Resistance to mildew equal to that of *Noah* and may also do without treatment. It is less fine ungrafted than grafted and suffers especially from phylloxera.

*Elvira.* — Same remarks.

*Herbemont.* — More resistant to mildew than *Jacquez* and is easily protected by a few sprayings. Grafted on *Rupestris* it dies (effect of thyllosis). Ungrafted it suffers much from chlorosis. Is particularly affected by lime, but in clays or sandy loams containing little or no lime it grows wonderfully and resists phylloxera for a fairly long time. Wine excellent.

NEW HYBRIDS. — 71-61C. — Brother of 71-10 and fairly resistant to mildew and, to a certain extent, to phylloxera; it might be grown in soils little subject to phylloxera, or cool and deep. It is less fine grafted on *Rupestris* than ungrafted (thyllosis).

71-06 C. — Very high resistance to mildew, superior even to that of *Noah*.

71-20 — One of the best of the Bayard direct bearers. Its foliage is very healthy, so is its fruit except in cases of very violent and very early attacks of mildew. It gives a large yield, ripening at the same time as *Carrigan* and *Mourvèdre* and is, therefore, suited to the western districts of France in the soils previously occupied by *Mourvèdre*. Wine without any special taste or smell, very good to drink alone and for making good brandy. For this purpose it could be of value in *Armagnac* and *Charentes*. It can be grown ungrafted in soils little subject to phylloxera and containing little lime, or cool and deep. Does well on *Rupestris*.

1 *Seibel.* — High resistance to mildew. Very fertile though not very regular. Is not resistant to phylloxera but does well on *Rupestris*. It needs at least one early treatment and one at flowering time. The wine has a slight flavour of *Lincecumii*.

29 S. — Has too strong a musty taste; bears very well.

1020 S. — Does not appear to deserve all the good said of it; suffers from mildew, phylloxera and grafting.

128 S. — Early; does very well when grafted, but insufficiently resistant to phylloxera and must be treated several times with sulphate.

142 *E. M.* — A hybrid,  $\frac{1}{2}$  *Vinifera* and *Riparia*, obtained at the School. Its yield is small, but it is remarkably resistant to mildew.

4401. *Couderc.* — Always proves resistant to disease but its yield is irregular. It may be grown ungrafted in cool or deep soils little subject to phylloxera. Grafted on *Rupestris* it is very vigorous, even too much so, and would probably be better grafted on *Riparia*.

*Jouffreau.* — Is only an *Auxerrois-Rupestris* = *Pardes*.

28-112 *Couderc.* — Produces little and is affected by sulphur or scorching; does not do well grafted; very resistant to mildew.

580 *Jurie.* — Very resistant to mildew and almost sufficiently so to phylloxera in soils little subject to the disease. Bears well in favourable weather, sometimes non-sets. Does not require treatment.

132-11 *Couderc.* — Always fairly immune to mildew. This is one of the few hybrids which do not require sulphate spraying except under extremely unfavourable conditions. Does well ungrafted.

60 *S.* — Fine bunches; sufficiently resistant to mildew and phylloxera.

138 *S.* — Always covered with grapes which often weaken it considerably and ripen irregularly.

1025 *S.* — Valuable; fairly resistant to mildew and phylloxera. Bears well. Wine of good quality.

2007 *S.* — Appearance and almost the yield of *Aramon*. A fine neutral wine; no special flavour or smell. Hardly resists anything and does not ripen its wood in France.

9 *S.* — Very resistant to mildew but not very vigorous.

365. — Very resistant to mildew and perhaps to phylloxera as well with an almost satisfactory yield. The wine is strongly coloured and, unfortunately, has a *Rupestris* flavour.

880 *S.* — A white hybrid very valuable on account of its high resistance to mildew but which does not appear to resist phylloxera. The clusters strongly resemble those of the French vine. Fruit of no special flavour or smell and even pleasant, subject to grey rot as soon as ripe, which is both a defect and an advantage. A plant which should be kept in sight. Does very well grafted.

1000 *Seibel.* — Very resistant to mildew and perhaps sufficiently so to phylloxera in soils which are little subject to phylloxera or in vegetable mould. Ripens early with a production satisfactory for central France. Wine of a good colour, not too thick and may be drunk unadulterated. Would probably prove of value in the Rhône and Saône-et-Loire. It is subject to anthracnosis, but may be protected by washing with iron sulphate.

6239 *Castel* and 129-4 *Malègue.* — Their merits have yet to be confirmed.

157 *Gaillard.* — A heavy bearer. It is little subject to mildew though it is well to spray it once or twice with sulphate. Does not resist phylloxera. It is rather weak and should be grafted on strong stock, well cultivated and manured as its fertility has a tendency to decrease. There are



sometimes spots of scorching on the leaves, especially when grafted, but they are of no importance. Large fruit with rather a marked but agreeable flavour which recurs in the wine.

22 *Baco*. = *Maurice Baco*. — A heavy bearer, 3 or 4 clusters per branch. Foliage similar to that of *V. Labruna*, not immune to mildew though resistant to a certain extent. Grapes resembling those of *Folle*, a little acid, but neutral. Wine neutral, quite like that of *Vinifera*. Should make good brandy. Does very well on a vigorous stock.

*Oiseau-Blén* = 503 *Couderc*. — Very resistant to mildew and even to phylloxera in certain soils. Yield rather small but satisfactory where the vine is grown as an accessory. It is spreading largely on the slopes of the Ardèche because of its erect bearing and other characters. It is a vine for the farmer or metayer.

24-23 *Baco*. — Very resistant to mildew but yields very little.

The substitution of direct bearers for French vines is justified neither by the abundance nor the quality of the produce as the ordinary varieties can give more abundant and better produce than the hybrids. Nor is it always justified by a satisfactory resistance to phylloxera to assure sufficiently long duration. Only a few of the hybrids can be grown ungrafted in all soils if there is not too much lime.

In a rainy climate or cool soil, little subject to phylloxera, and in sandy and sandy-loam soils, in deep and rich land which allows the plant to heal rapidly wounds caused by insects, many of these new vines can be grown ungrafted. The lands of the South West, where the French vine held for a long time, or is still holding, without treatment, are the most favourable for direct bearers with good, or even medium, resistance to phylloxera. In a warm and dry climate direct bearers, barring the exceptions already mentioned, should be grafted on strong, vigorous stock, *Rupestris*, 1202, 93-5, 3309, 3306, etc. Only hybrids with exuberant vegetation or a tendency to non-set should be placed on *Riparia* or similar plants.

The use of these vines is justified by their resistance to disease, especially mildew. The characters of each of them from this point of view is now known. They should, therefore, be grown:—

- 1) in rainy districts, where diseases are severe: east, centre, north, west, south-west, and mountainous districts;
- 2) everywhere where the vine is cultivated as an accessory and can not be given the requisite care;
- 3) not even the best of them are suited to the production of the best wines, but in large vineyards a small place might be set apart for them for the production of wine for the workers.

In less hot and dry climates their use, for the moment at least, is very restricted, but they might be used either grafted or ungrafted, according to the soil, wherever mildew is particularly difficult to control—land frequently flooded or holding rain for a long time in hollows round the roots of plants, spongy lands impracticable for a long time after rain, where treatment is nearly always badly carried out and where mildew usually occurs every year.

4) all vines might be re-grafted using direct bearers as scions, not to avoid subsequent treatments, which would be useless, but to assure the taking of the stock in the ground. These, like French vines, are frequently destroyed by mildew in unfavourable years ; it is clear that hybrid grafts would resist much better.

There are other, more recent, hybrids, of greater promise than those studied. M. COUDERC especially has some of which great hopes are entertained. The same may be said of some of those of M. BERTILLE-SEYVE, etc.

**1251 — The Effect of Pruning on Grafted Vines (1).** — LEBRUN, L., in *Le Progrès agricole et viticole*, Year XXXV, No. 29, pp. 61-65, Montpellier, July 21, 1918.

The author (Director of the Agricultural Service of the Marne Department) gives the results and conclusions he obtained from a series of investigations in the experimental vineyard of the departmental laboratory of Châlons-sur-Marne, France, where care of the vines has been irregular since the beginning of the war.

The experimental plot, along a wall on a hillside, is exposed to the south and contains 38 to 45 % of lime very apt to cause chlorosis. The vines are Vert doré and Chardonnay grafted on 1202 and 41 B (Vert doré on 1202 is distinctly inadvisable). The method of pruning has a marked influence on the longevity of the vine and preference should be given to that in which the stock develops most. This effect is clear if it be admitted that the reserves accumulate in the old wood in larger quantities when it is of greater volume. Unfavourable years distinguished by serious attacks of mildew, lack of fertiliser and attention may follow each other with no result other than a more or less marked decrease in vegetation. This, however, is not the case when the stock is reduced, as in the Guyot pruning method, as it is much more sensitive and may disappear if neglected for one or two years. The question arises whether large trellis-work does not contribute efficiently to the resistance of the plants to phylloxera and does not suffice to explain their relative immunity.

## FORESTRY

**1252 — The Bark of Scotch Pine and Spruce.** — WRETLIND, J. E., in *Högsnärdsföreningens Tidskrift*, Year XV, No. 1, pp. 22-60 + 14 Figs. Stockholm, 1917.

This paper gives the results of a thorough study of the thickness of the bark of Scotch pine and of spruce made in forests in central Sweden.

The following conclusions were drawn from the many numerical data collected: — 1) the thickness of the bark of Scotch pine at breast height is in constant ratio with the diameter of the trunk, whatever the age of the plant ; in the spruce, on the other hand, the ratio of the bark to the diameter decreases when the diameter is larger ; 2) the bark of the spruce decreases appreciably in thickness during drying ; thus, for example, the bark of a forty year old spruce with a diameter of 22.7 cm. at breast height, dried at the temperature of an enclosed space,

(1) See R. May, 1917, No. 452. (Ed.)

decreased in thickness in 48 hours, passing from 4.4 mm. to 2.7 mm.; the decrease in the whole diameter, including the bark, was, in the same length of time, from 22.70 cm. to 22.55 cm.; apart from its commercial importance this fact calls for further investigation; 3) in the spruce, the bark is usually thicker at the base than at breast height; it decreases in thickness up to 20 or 30 % of the height of the tree, and again thickens towards the top. None of these differences are very marked, and are such that, in practice, the percentage of bark at breast height may be applied to the whole trunk.

The author recommends that, when standing wood is sold, the measurement be taken under rather than outside the bark, and that the thickness of the bark should be determined for each station. He also proposes a formula to calculate its percentage of the cubic mass.

### LIVE STOCK AND BREEDING.

1253 - **Stock-poisoning Plants of the Range, in the U. S. A.** — MARSH, C. D., in the U. S. Department of Agriculture, *Bulletin No. 575*, pp. 1-24 + 30 Plates. Washington, July 23, 1918.

HYGIENE

Very heavy losses in live stock are caused by poisonous plants. The exact extent of these losses is not known, but, in some States, it is estimated to be as much as 3 to 5 %, and in others is still higher. In Colorado such losses amount to a million dollars annually, while the annual loss of sheep in Wyoming is placed at 14.6 %. As the animals which die are mostly adult ones, ready or nearly ready for market, the loss is all the more severe. For some years past the U. S. Department of Agriculture has been making experiments with poisonous plants. Such experiments are especially difficult because many of the plants toxic to animals only cause illness when eaten in considerable quantities. The aim of the bulletin under review is to give a short description of the more important plants poisonous to stock, so that they may be easily recognised by non-technical people. The effects produced by the plant are also described as well as the time when losses usually occur together with the means of avoiding them. Special attention is drawn to the fact that most poisonous plants, with the exception of the loco (1) group, are distasteful to stock, who only eat them when there is a lack of other food. Poisoning frequently occurs when sheep are kept too long on the same bedding ground; during the first few days they eat all the available plants along the road they pass going backwards and forwards on each day, with the result that they are almost sure to consume poisonous plants later on. As far as possible sheep should be left to graze under natural conditions, that is to say, they should be able to go freely and slowly, separated from each other, and not allowed to graze over and over upon the same ground.

The plants discussed in the bulletin include: —

(1) The word "loco" is from the Spanish and means mad.

THE LOCO PLANTS (1), the most destructive of all poisonous plants. The group includes white loco, or rattle weed (*Oxytropis Lambertii*); purple loco, woolly loco, or Texas loco (*Astragalus mollissimus*); *Astragalus diphysus*. LARKSPURS (2): — *Delphinium cucullatum*, *D. Barbeyi*, *D. Menziesii*, *D. bicolor*, *D. virescens* (= *azureum*). WATER HEMLOCK (*Cicuta*) (3). DEATH CAMAS (3), *Zygadenus venenosus*, *Z. elegans*, *Z. paniculatus*. LUPINE, also known as blue pea and wild bean. LAUREL, *Menziesia glabella*, black laurel (*Leucothoe Davisiae*), *Ledum glandulosum*, white laurel (*Azalea occidentalis*), *Rhododendron albiflorum*. COMMON BRACKEN FERN (*Pteris aquilina*). WILD CHERRY. MILKWEED (*Asclepias*). WOODY ASTER (*Xylorhiza Parryi*). COLORADO RUBBER PLANT, or pingue (*Hymenoxys floribunda*). WESTERN SNEEZEWEED, or yellow weed (*Dugaldia Hoopesii*), *Psoralea tenuifolia*.

1254 — The "Enfermedad de los Rastrojos" or "Locura de los Caballos" in the Maize Growing Regions of the Argentine; Means of Control. — *El Campo*, Year II, No. 11, p. 350. Buenos Aires, 1918.

In the maize-growing regions of the Argentine and particularly in the province of Santa-Fé, a non-contagious disease of the horse appears from time to time, as in 1911 and 1918. The disease affects farm horses fed on more or less mouldy maize (whole plant or grain), or put to pasture on maize stubble. The disease is called "enfermedad de los rastrojos" (stubble disease) or "locura de los caballos" (horse madness). The mortality may attain 50 % of the farmer's stock, but decreases when the soil is begun to be cultivated for the new crop.

In some cases the disease has a very rapid course. Generally, however, it shows the following symptoms:—blindness or squinting, trembling, constipation, great excitement. In other cases it is shown by great depression and by paralysis of various parts of the body. At the post mortem examination the brain is found to be extremely softened in one or both hemispheres (usually the left).

The experts of the Veterinary Department ("Dirección general de Ganadería") of the Argentine Ministry of Agriculture, who have studied the disease very thoroughly, recommend the following treatment:—

1) If the horses are at pasture in maize fields where only the stubble remains, they must be removed at once and kept in enclosures where maize is not grown.

2) As soon as the first symptoms of the disease are seen, a hypodermic injection of pilocarpine hydrochlorate (0.2 gm.) + eserine sulphate (0.05 gm.) + distilled water (10 gm.) should be given in the neck.

3) Sometimes horses thus injected are very depressed; to stimulate them an injection must be given (and repeated 2 or 3 times a day, if necessary) composed of caffein (1 gm.) + sodium benzoate (2 gm.) + distilled water (5 gm.).

(1) See also R. Dec., 1915, No. 1309. — (2) See also R. Dec., 1915, No. 1309 and R. Jan., 1918, No. 55 — (3) See also R. Oct., 1914, No. 916, and R. Dec., 1915, No. 1309. (Ed.)

4) During the 2 or 3 days after treatment each animal must be given 2 tablespoonfulls of creoline mixed with a litre of water.

1255 - On the Isoanaphylatic Poisoning Due to Certain Immunising Serums. — CARPANO, M., in *La Clinica veterinaria*, Year XLI, No. 70, pp. 261-274. Milan, May, 1918.

The author describes the observations he has made at the "Istituto Siero - Vaccinogeno Eritreo" and at the Bacteriological Laboratory of the Army Veterinary Service at Rome, on the special hypersensibility shown by certain sick animals as regards respective and homologous immunising serums. These observations are not only of interest for the scientific study of the phenomena of immunity but also for the practical application of ordinary serotherapeutic treatment. They deal directly with streptococcal infections, cattle plague and horse sickness.

The *toxic property* of certain serums, even when normal, injected into animal species other than those from which they have been obtained, has long been known. It was thought that the toxic phenomena should be exclusively attributed to the different origin of the albumins, but it has lately been found that the phenomena may also occur, but less frequently, when albumins coming from the same species and even the animal treated are used, *i. e.*, using *isoalbumins* and *auto-albumins* respectively (PICH and YAMONOUCHI, 1908; ACHARD and TOURAINE; 1912; WIDAL, ABRAMI and BRISSAUD, 1912; PETRI, 1913; MIRICAPILLO, 1913; MEILLO, 1913; NETTER, 1915; NETTER, KOEHLIN and SALAMIER, 1916; MARIE, 1916; FINZI, 1916). The author has observed similar phenomena in the following cases:—

1) A horse that had been inoculated with a culture of streptococci and, 5 days later, with polyvalent antistreptococcal serum, showed phenomena similar to those usually occurring with anaphylactic disturbances. But in this case there was no true anaphylaxis, on account of the absence of the chief factors on which the classic form of the phenomenon is based, *i. e.*:—  
a) heterogeneous serum; b) the existence of a preceding action leading to the phenomenon. In addition, the phenomenon of antianaphylaxis or de-anaphylaxis, which renders the organism insensitive after a first anaphylactic crisis, did not show itself.

2) In cattle injected in the jugular with 80-100 cc. of homologous anti-plague serum, the author has frequently found that the grave poisonings often followed by sudden death were not due to the phenol contained in the serum (cattle tolerate up to 2 gm. injected intravenously with impunity), nor to the traumatic action of the albumin flakes suspended in the serum, nor to air bubbles introduced into the veins. As a result of this the author abolished the intravenous method and has limited the treatment of cattle plague solely to subcutaneous serotherapy which, when given when the disease first shows itself, gives a high percentage of recoveries.

3) In horses suffering from horse-sickness and treated with a homologous serum, particularly when injected directly into the jugular. This serum has a powerful haemolytic action. THEILER made similar observations in 1904, during his researches on immunisation against horse-sickness in South Africa.

Given that, in all the previous cases, a homologous serum (*i. e.*, obtained from the same species of animal) was used, it must be admitted, contrary to the still current opinion, that the serum of certain organisms, whether specially treated or not, can possess the properties of antigens towards organisms belonging to the same species; in other words an *individual specificity*, whether acquired or natural, must be admitted. Those cases of hypersensibility observed in some of the animals treated are much more pronounced and frequent when the serums used are obtained from material hyperimmunised with animal products (virulent blood), as is the case with cattle plague and horse-sickness, than when they are obtained, on the contrary, from animals hyperimmunised with bacterial material, as is the case in streptococcal infection. The author gives this hypersensibility the name of "*tossicose anafilatoïde*" (anaphylactoid poisoning), thus indicating those reactions that are special to the organism, similar to the anaphylactic manifestations that occur in the organism itself as the result of the introduction of normal or immunised homologous serums, without there being a previous sensitisation (1).

The author discusses some of the hypotheses put forward to explain the origin of the phenomena in question: — above all, individual predisposition; presence of incompletely neutralised antigens in the serums; eventual reaction between the antigens contained in the sick organism and the antibodies introduced with the immuniser; presence of isoagglutinins, isoprecipitins and isolysins in the immuniser; complex modifications of a bio-physical-chemical nature undergone by the serums during their preparation, and which would give them antigenic or completely toxic properties.

**PRACTICAL CONCLUSIONS.** — In some infections, a certain number of sick individuals (consisting of predisposed subjects) can show a particular hypersensibility as regards homologous preventive immunisers, especially when they are introduced directly and in considerable quantities into the circulation; this is why intravenous serotherapy when it is the case of certain serums and in spite of their efficacy, is not free from disadvantages which, from simple, passing disturbances, may develop to the most alarming morbid symptoms and even cause the death of the subject.

**1256 — The Anaphylactic Nature of Parasitic Poisoning.** — VAN ES, L. and SCHEALCK, A. F. (Veterinary Department of the North Dakota Agricultural Station), in the *Annales de l'Institut Pasteur*, Year XXXII, No. 7, pp. 310-362 + 5 Tables + 5 Figs. + Bibliography of 20 Publications. Paris, 1918.

The part played by the filtrable, ultra-microscopic virus of VALLÉE and CARRÉ in infectious anaemia of the horse has been confirmed by many researches. Again, the recent explanations of the etiology of the disease proposed by MM. SEYDERHEHN (Strasbourg) during their researches on the pathological nature and treatment of infectious anaemia of the horse have

(1) BEHRING calls *anaphylactoid substances* those that reproduce the syndrome of anaphylaxia without there being a previous preparatory action. See PESCI, *Forme anafilattiche*, Turin, 1916. (Author)

greatly interested other workers. The results arrived at by the authors are given below.

Anaemia of the horse can be produced artificially, down to every detail, by injecting aqueous extracts of *Gastrophilus equi* and *G. haemorrhoidalis* (*Oestrus*).

Judging from its action and its behaviour as regards physical and chemical influences, the active constituent is an animal poison, called *oestrine* by the authors.

The toxic action of oestrine, exclusively specific for the horse (and ass), is reabsorbed by the gastro-intestinal canal; it occurs in the excreta of the larvae of *Gastrophilus* and that of the species *haemorrhoidalis* is much more toxic than that of the species *equi*.

Pernicious anaemia produced artificially in this way can be transmitted to healthy horses by means of the blood, and by the blood of the latter to other horses; in nature pernicious anaemia is not produced by an ultra-visible virus, but by oestrine alone.

The authors have checked their theory by a number of experiments:—

1) Study of the results produced by injecting the horse with extracts of the larvae of *Gastrophilus* (intravenous and subcutaneous injections; action of dialysis, alcoholic and acetone extracts and heat on the poison of *Oestrus*); 2) study of oestrine as regards its importance in the pathogenesis of the disease and on the eventually anaphylactic character of the reaction produced by the injections. In this way the authors have been able to formulate the following theory:—

There is no reason to believe that the species of *Gastrophilus* play a *specific part* in the etiology of pernicious anaemia of the horse; the severe poisoning following the injection of gastrophilic matter observed by MM. SEYDERHEHN and also by the authors, is not caused by a specific substance such as oestrine; it is simply the *manifestation of anaphylaxia* and is quite analogous to that produced by proteins. Many parasites sensitise their hosts which, after injection or instillation, give anaphylactic or allergic reactions. The more or less constant presence of the parasites in certain parts of the host's body makes the idea very plausible that the host is constantly charged with anaphylatoxins and it is quite possible that such a poisoning might lead to morbid conditions.

This hypothesis of a *parasitic anaphylaxia* raises many questions and opens a wide field to the investigator, such as:— the study of the consequences of anaphylactic poisoning and its relations with certain chronic diseases; practical application to the diagnosis of certain diseases; the study *in vitro* of anaphylactic sensitisation of parasitic origin, etc.

1257—Some Biological and Control Studies of *Gastrophilus haemorrhoidalis* and Other Bots of Horses, in the Dakotas and Montana, U. S. (1)—DOVE, W. E., in U. S. Department of Agriculture, Bulletin No. 597, 51 pp. + 4 Fig. + 5 Plates + Bibliography of 38 publications. Washington, April 9, 1918.

Three species of horse bots—the common bot-fly (*Gastrophilus in-*

(1) See also R. May, 1917, No. 458. (Ed.)

*testinalis*), the throat bot-fly (*G. nasalis*), and the nose fly (*G. haemorrhoidalis*) — occur in the United States, and each is a source of considerable injury to horses. This injury is produced through irritation caused by the flies at the time the eggs are laid and by the attachment of the larvae, or bots, in the alimentary tract.

*Gastrophilus intestinalis* and *G. nasalis* are widely distributed in the United States, but *G. haemorrhoidalis* is confined to the North-Central and northern Rocky Mountain States.

The nose fly (*G. haemorrhoidalis*) is by far the most annoying to horses at the times its eggs are laid. The adults appear early in June and reach the maximum of abundance during the first half of the season, disappearing with killing frosts. The eggs are deposited on the minute hairs on the lips, and those near the edges which are kept moist and receive friction hatch in from 5 to 10 days. The larvae are taken in with food or water and attach themselves to the walls of the stomach. Here they remain until the following winter or spring and then migrate to the rectum, where they reattach. Before leaving the host they usually attach close to the anus and protrude from it. They remain in this position from 40 to 70 hours. After dropping to the ground the bots seek protection and pupate in from 18 to 170 hours later. The pupal stage lasts from 21 to 68 days. The adults are very active and as they deposit only one egg at a time they are not so frequently seen about horses as are the adults of the common bot-fly. They take no food in the adult stage. Their length of life is from 1 to 7 days.

The throat bot-fly (*G. nasalis*) deposits its eggs on the hairs under the jaws and to some extent on the shoulders and other parts of the host. The larvae of this species attach themselves to the walls of the pharynx and also to those of the stomach and duodenum. They do not reattach in the rectum or at the anus as do the bots of the nose fly. Pupation occurs in from 1  $\frac{1}{2}$  to 2 days after the larvae have passed from the host, and adults emerge in from 20 to 56 days later. The adults are somewhat longer lived than those of the nose fly. The flies cause considerable annoyance to horses during oviposition but not as serious as in the case of the nose fly.

The common bot-fly (*G. intestinalis*) usually appears later in the season than the nose fly and becomes most abundant just before killing frosts. The eggs are deposited on all parts of the body but preferably on the fore legs. They hatch upon the application of moisture and friction. From 9 to 11 days after oviposition appears to be the most favourable period for hatching, although some may hatch as early as 7 days and others as late as 96 days after oviposition. The larvae attach in any part of the stomach but the last-stage bots are found mostly in the left sac. They continue to drop from the host for a long period of time. Pupation takes place in protected places on the surface of the soil and the pupal stage lasts from 40 to 60 days.

All *Gastrophilus* larvae are surprisingly resistant to chemicals. The treatment of horses with carbon bisulphide in three doses followed by a



physic is satisfactory if administered in late autumn. Spring treatment is less effective, as the full-grown larvae are more resistant, and many of the nose-fly bots have left the stomach and passed back to the rectum at that time.

Larvae of *G. haemorrhoidalis* may be removed from the rectum mechanically, but this is laborious. The use of enemas containing insecticides is ineffective.

As a repellent, pine tar mixed with other material gave good results against the common bot-fly and the throat bot-fly. Such mixtures may be utilised to cause the flies to lay eggs on parts of the body less accessible to the horse's mouth.

Various nose protectors are in use against *G. haemorrhoidalis*, but there are objections to many of them. A piece of leather suspended below the lips from the bit rings is simplest and best. For animals on pasture a halter with a box-like arrangement and throat cover has been devised to protect horses against infection by all three species.

Kerosene oil used as a wash is ineffective in destroying the eggs of *Gastrophilus*. A 2 per cent nicotine-sulphate solution was only partially effective. Nitrobenzine gas yields good results at 25, 24 and 10 hours' exposure, but only a small percentage was killed at 4 hours. The phenol compounds, by a contact application, seem to be the most effective in destroying young larvae and preventing the further development of embryos. Carbolic acid containing 2 per cent phenols is satisfactory for destroying eggs when applied to the infested parts of the host.

1258—Experiments in the Transmission of Trichinae in the U.S.A.—RAFFENSPERGER, H. B. (U. S. Bureau of Animal Industry, Chicago, Ill.), in the *Journal of the American Veterinary Association*, Vol. LIII, New Series, Vol. 6, No. 3, pp. 363-367 + Bibliography of 7 Publications. Ithaca, N. Y., 1918.

Certain workers (HÖYBERG, SALZER) have concluded that trichinosis may result from the swallowing of faeces or intestinal contents of animals harbouring the intestinal stage of the parasite. Other workers (LEUCKART, PAGENSTECHER, STÄUBLI) have concluded, however, that infection cannot be brought about through swallowing intestinal trichinae or the newly born larvae which may be found in the faeces of animals harbouring trichinae in the intestine. In the course of the author's investigations on trichinosis, he carried out some experiments similar to those of STÄUBLI. Rats and mice were fed on trichinous pork, and after their death, which occurred 2, 3, 4, 5, 7 and 10 days after the artificial infection, numerous live trichinae were found in the intestines. The contents of the duodenum and jejunum were fed to guinea-pigs; these were killed 40 to 50 days later, when their diaphragms were carefully examined under the microscope. The examination always gave negative results.

Concerning the stage at which trichinae in the muscles become infectious it is usually stated in the literature that non-encysted trichinae are not infectious. The author's results confirm this opinion:—rabbits, fed on trichinous meat, were killed 15 or 18 days later, when examination of

the diaphragm revealed the presence of many *unencysted* larvae. The fragments of the diaphragm were fed to other rabbits, which were killed after about 30 days; examination of the diaphragm, in this case, always gave negative results. But when the former rabbit had encysted larvae present in its diaphragm, that of the latter animal was also infected.

CONCLUSIONS: — The evidence obtained from the experiments supports the generally accepted opinions that trichinae are not transmissible through the faeces, that unencysted trichinae are not capable of developing when meat containing them is ingested, and finally that trichinae are spread from one host to another *only as a result of swallowing meat containing the encysted larvae of the parasites.*

1259 — **Cattle Lice and How to Eradicate Them.** — IMES, MARION, in *U. S. Department of Agriculture, Farmers' Bulletin* 909, 27 pp. + 14 Figs. Washington, February, 1918.

The bulletin under consideration treats of the following lice: — the short-nosed cattle louse (*Haematopinus eurysternus*), the long-nosed cattle louse (*Linognathus vituli*) and the common biting louse (*Trichodectes scalaris*). The life history and habits of each are described. When separated from their host the first two species live about 7 days, the third one only about 4 days. Newly hatched lice only live 2 or 3 days if they find no host. The longevity of the lice and the viability of their eggs when separated from their host are of great practical importance in their eradication.

The parasites detached from the animals drop in the corrals, stables and pastures, and through the adults die in about a week, the eggs may hatch if the weather is mild and continue to infect the herds. Infected stables should be cleaned and disinfected with coal-tar creosote suitably diluted. Animals which have been dipped or otherwise treated to free them from lice should not be taken to contaminated quarters or those they occupied previously unless they have first been cleaned and disinfected or left vacant for about 20 days.

Methods of controlling cattle-lice are: —

1) Hand applications: — *a*) dusting powders (naphthalene and pyrethrum), which are useful in holding the parasites in check when the weather is too cold for dipping or spraying; *b*) greases: — cottonseed oil and kerosene in equal parts;  $\frac{1}{2}$  pint of kerosene and 1 lb. of lard; crude petroleum; *c*) liquids.

2) spraying with a hand pump (or an orchard spray) with the liquids recommended for dips; two treatments should be given, 15 or 16 days apart.

3) Dipping in arsenical solution, coal tar creosote or nicotine.

The first two methods are suitable for small herds, the third (the most efficacious) is suitable for large herds. One arsenical or coal tar dip is usually sufficient to destroy the long-nosed louse and the common biting louse, but for the short-nosed louse two treatments at intervals of 15 or 16 days are necessary. The cattle should be well examined after the second dip as live lice sometimes remain and a third dip may be necessary about 16 days after the second.

The arsenical dip is made up of 4 lb. 85 % pure caustic soda + 8 lb.

99 % pure white arsenic in fine powder + 8 lb. sal soda crystals + 1 gallon pine tar + sufficient water to make 500 gallons. This dip is usually used cold, but, so as to avoid chills its temperature should be from 65° to 90° F.

Nicotine dips are very efficacious if they contain not less than  $\frac{5}{100}$  of 1 % nicotine; if dips more concentrated than 0.05 are used they are dangerous to the cattle especially if used hot. They are usually given warm, but their temperature should not exceed 110° F. Flowers of sulphur is sometimes added to nicotine dips; it dissolves very slightly and clings to the animal's skin for a long time, thus helping to prevent re-infection.

Two dipping plants are described, one in wood, the other in concrete; both are similar in their general design to that described by the author for sheep (1). The length of the vat varies from 24 to 100 ft. according to the number of animals to be dipped, the width is about 3 ft. and the depth 8 ft. A plant should include pens for keeping the cattle in before and after dipping. The passage ending in a chute which leads to the dip must be well designed. The two plans given show the measurements and detailed construction of the vat, and running and crowding chutes. The plant is completed by a heating system. Attention should also be given to the easy draining of the water.

**1260 - Avian Malaria Caused by *Plasmodium relictum* (Proteosoma); Experiments in Algeria.** — SERGENT, E. and E. (Pasteur Institute of Algiers), in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 8, pp. 382-388 + 2 Figs. Paris, August, 1918.

For twelve years the authors have studied at the Pasteur Institute of Algiers avian malaria caused by *Plasmodium relictum*, which in many ways resembles human malaria. They now publish the still incomplete results of the 560 experimental cases observed.

**INFECTION AND IMMUNITY.** — All the canaries (560) contracted the disease as a result of bites from infected *Culex* or by intraperitoneal inoculation of blood of an infected bird. The course of the disease is similar with both methods of infection:— period of incubation, 3 to 10 days; period of acute infection, 9 days, with 61.3 % mortality. Relative immunity.

**METHODS OF INFECTING THE BIRDS.** — 1) Intraperitoneal inoculation; 2) rubbing *Culex* on to the skin of the canary (in the proportion of 4 cases out of 10); intrarectal injection (1 case out of 6).

**MOSQUITOS SUBJECT TO INFECTION.** — The complete sexual evolution of *Plasmodium* may take place in *Stegomyia fasciata*, *Culex sergenti* Theobald, *Theobaldia spathipalpis* Rondani, *Acartomyia mariae* Serg. and Theob. (the larvae of which only live in the salt water of hol lows in the rocks along the coast of the Mediterranean). The passage of *Plasmodium* to the eggs has not been observed and there is no acquired immunity amongst mosquitoes.

A description is given of the trypanosome in the blood of the canary.

(*Serinus canarius* Koch), and of another trypanosome observed in the blood of the Algerian sparrow (*Passer domesticus* L.).

ANATOMY  
AND  
PHYSIOLOGY

1261 — **Complementary Studies on the Modification of the Germ Cells of Mammals; Effects of Inhalation of Alcohol Vapour on Guinea-pigs and their Progeny.** — STOCKHARD, C. R. and PAPANICOLAOW, N. (Department of Anatomy, Cornell Medical School, N. Y.), in *The Journal of Experimental Zoology*, Vol. XXVI, No. 1, pp. 119-226 + 10 Tables + 9 Figs. + Bibliography of 18 Publications. Philadelphia, 1918.

The results of researches carried out for over 6 or 7 years with the aim of observing the modifications produced in the germ cells of mammals by the constant inhalation of alcohol vapour. Other experimentors, especially PEARL (1), using a similar method, and technique to that of the author, have recently published the results of similar researches on other mammals or on birds. Although PEARL found the guinea-pig to be more sensitive to poisoning than fowls, the author is in agreement, speaking, broadly, with that experimenter whose results he discusses at length.

POULTRY

1262 — **Acorns as Food for Poultry.** — CRANFIELD, H. T., in *The Journal of the Board of Agriculture*, Vol. XXV, No. 5, pp. 573-576. London, August, 1918.

The use of acorns as a substitute for maize in poultry feeding is recommended. Acorns have recently been recommended as a cattle food and PETERMANN (*Die landwirtschaftlichen Versuchstationen*, Vol. LXXXII, Pt. 1-2, p. 93) considered them a suitable poultry food after having been dried and ground. In the autumn of 1917 acorns of different varieties were collected, dried over a hot-water tank for several weeks, ground and sifted (the husks being thus completely separated from the kernel). The kernel (80 % of the acorn) showed the following percentage composition on analysis: — moisture, 13.86; oil, 4.57; albuminoids, 7.88; soluble carbohydrates, 67.82; fibre, 3.63; ash, 2.24. The meal thus obtained was fed to twelve pullets and five two-year-old birds, all in full lay. Before the experiment they were receiving fish meal, sharps, cooked vegetables, wheat screenings, oats and maize. The grain and sharps were gradually replaced by crushed acorns and acorn meal. The experimental ration was continued for four weeks. The birds suffered no ill effects. The acorns are slightly binding but counteract the rather laxative action of fish meal. There was no great difference in laying.

It has been stated (*Fühlings landwirtschaftliche Zeitung*, 1904, p. 808) that if acorns are fed to hens in too large quantities they cause black discolouration of the egg yolk (2). This defect was not observed during the author's experiment in which each hen received daily 2 oz. of acorn kernel.

CONCLUSIONS. — Acorns contain no substance injurious to poultry. Their food value is equivalent to a mixture of oats and maize. They may completely replace grain in poultry feed if their slight deficiency in protein is made up.

(1) For the technique of this kind of research and the results so far obtained, see the abstract of PEARL's three reports, in *R.*, September, 1918, No. 1018. (*Ea.*)

(2) See *R.*, 1915, No. 1067. (*Ed.*)

1263—The Tatu (*Tatusia novemcincta*) as a Pest of Farm-yards in Brasil.—  
See No. 1193 of His *Review*.

1264—Silkworm Rearing in Indo-China.—GACHON, A., in the *Congrès d'Agriculture coloniale, Gouvernement Général de l'Indochine*, Hanoi Series, No. 7, 8 pp Hanoi-Haiphong, 1918.

SERICULTURE

The cultivation of mulberry and silkworm rearing has been practised in Indo-China since remote times and, in nearly all the countries of the Union, silkworm rearing might be greatly and rapidly developed. Many circumstances have contributed to making prosperous this essentially agricultural and home industry. The mulberry grows easily and develops well. The worms may be reared throughout the year in some districts and during at least eight months in the least favourable ones. Abundant, cheap labour and the free time left by the small variety of crops grown are very important factors in the possible development of silkworm rearing.

France buys annually in the Far East raw silk to the value of nearly £8 000 000, manufactures it and exports most of it as silk materials throughout the world. Indo-China might supply France very largely, as is shown by the quotations, with material equal to the best products of Canton, of raw silk and waste prepared by European methods chiefly in Tonkin and in Annam. These goods are already appearing on the French market. These considerations led the Government of Indo-China to encourage the improvement and development of the silkworm industry by all the means in its power, in order to export the produce to France.

The author (Inspector of the Agricultural and Commercial Services), after describing the cultivation of the mulberry and silkworm rearing in Indo-China (1), gives an account of the work done in the colony, especially by the Administration, to develop silkworm rearing. In 1905 the Administration appointed a silkworm egg specialist and founded an establishment at Phulang-Thuong for the production of eggs selected by the Pasteur method. At the same time pamphlets of a kind to be understood by the natives were drawn up in French, Quôc-ngũ, and Chinese. They gave simple, rational and practical methods for improving silkworm rearing, spinning and the preparation of waste, and were widely distributed in the silk centres and in all the provinces where they might have a useful effect.

Model and experimental silkworm nurseries and two egg-production establishments, one at Bach-hat (near Viêt-n) and one at Kiên-an (near Haiphong), were opened. The working of the egg-production centre of Phulang-Thuong, the oldest, best equipped and largest of the colony, was assured from 1907 to the end of 1916 by a commercial company controlled by the Administration and prepared to supply 3 000 000 layings. The establishment was taken under direct control on January 1, 1917, and its production exceeded 3 500 000 layings in 1917. The Bach-hat egg-production establishment, the second in importance, has been managed by the Administration since its foundation in 1914. It distributed free of charge

(1) This subject was studied by M. LEMARIS in the *Bulletin de l'Office colonial* and reviewed in R., Sept., 1912, No. 1330. (Ed).

600 000 layings in 1914, 1 000 000 in 1915, 1 650 000 in 1916, and about the same number in 1917. The Kiên-an egg-production centre was only established in 1916 and its production has reached 110 000 layings, in 1917 it exceeded 250 000. When the Phulang-Thuong establishment was opened a silkworm breeding research station was attached to it to study the introduction of foreign species, crossings, etc.

Of recent years Cochin-China, Annam, and Cambodia, following the methods used in Tonkin, have opened establishments for egg selection by the Pasteur method, model and experimental silkworm nurseries and plantations, as well as workshops for studying improved methods of silk spinning, the preparation of waste, and weaving for the European market. Since about ten years the Administration, especially in Tonkin, has made great sacrifices in order to develop the silkworm industry.

The silk-spinning basins has been altered and perfected giving as much consideration as possible to the native methods and customs. Many basins have been supplied free of cost to spinners who have thus been enabled to produce raw silk saleable in France either as they arrive or after a very simple system of re-reeling and re-boiling. The waste and by-products of the spinning industry, prepared by a rational, more profitable method than formerly, may now easily be exported to France. A premium of \$ 0.80 per kg. (about 9d. per lb.) was instituted in 1907 and continued till the end of 1915 in favour of steam spun or reeled raw silk exported to France, in order to help and encourage those engaged in the trade. There are three steam spinning mills in Tonkin: — 1) that opened in 1906 at Nam-dinh, the most important, with 100 basins; 2) that of Thai-binh, opened in 1909, with 40 basins; 3) that of Kiên-an, opened in 1915, with 60 basins. A fourth is to be built during 1918 at Viêtri. Large numbers of improved direct basins spinning for export, have been set up in the provinces of Nam-dinh, Thaininh, Ninh-binh, Hadong, and at Bach-hat. Certain mills, better equipped than others, have boilers for heating the water of the basins by steam, a more regular method than by wood, but the reeling apparatus is always on the model or that recommended by the Administration.

The European silk industry has been centred in Annam in the Binh-dinh, at Phuphong, near Quinhone, since 1903. A French company owns there a spinning mill with 100 spinning basins, a silk-twisting machine and a large weaving machine. All the products, raw silk, waste, and materials (crepe, crepon, pongee, etc.) are exported and sold in France.

The Annam Protectorate has installed in various silkworm rearing centres, small egg-producing establishments managed by native agents of the local Agricultural and Commercial Services under the direction and supervision of French officials of the Service. As in Tonkin these small establishments work in co-operation with the model silkworm nurseries, or obtain their supplies from rearers who have specialised in egg production.

In Cochin-China an Annamite company for spinning and weaving silk by European methods was founded at the beginning of 1914. A factory was built for receiving the material which has not yet been delivered, owing to present conditions. The Orphanage of the Sisters of Culac-Giêng has a

hand-weaving factory and a factory for crepons, pongees, figured silk and silk embroideries for the European markets. In spite of somewhat primitive equipment the products of this industry are very satisfactory and find a ready sale. The local body of the Agricultural and Commercial Services has two egg-production centres, one at Saigon and one at Tân-Châu, supplied by model silkworm nurseries belonging to the Administration and expert rearers. Many model nurseries and mulberry plantations, each having a small factory for silk spinning and weaving by improved native methods, have been established in silkworm rearing centres. Each year the Agricultural and Commercial Services of Cochin-China distribute gratis an average of 1 million selected layings. Cambodia has an egg-production establishment supplied with cocoons from model nurseries or produced in chosen centres by careful breeders. The selected eggs are distributed free of charge to all breeders who apply for them, an annual average of 1 million layings being distributed among the silkworm districts of Cambodia.

A silkworm-rearing research station has been opened at Phnompenh and has already given interesting results. Varieties of native worms have been most carefully selected and have given very strong white and yellow types of very pure colour. The experimental spinning and weaving factory has attracted the attention of the French and Cambodian populations and a company was recently formed to start a steam silk spinning factory with 100 basins and, later, a factory for machine weaving.

The reduction of the taxes on mulberry plantations made in 1905 by Governor General BEAU has given good results but less far-reaching than was expected, by reason of the native communal organisation and the payment of taxes by villages. The conferment of honorary rewards, of small grants and prizes given in competition would appear to have more opportunity of starting a movement for the extension of mulberry plantations and the improvement of silkworm rearing methods and the silk export industry.

For several years the "Musée agricole et commerciale" of Hanoi, belonging to the Agricultural and Commercial Services of Tonkin, has given professional instruction to numerous Annamites. A model silkworm nursery and mulberry plantation, a set of direct basins and several improved weaving looms, make it possible to follow the full cycle of the silk industry. This instruction has proved most useful and many Annamites owe new means of earning to it. It has made possible small home industries which need no help from the Administration. Although the silk industry workrooms of the Hanoi Museum have had to make room for other trades, equally interesting as home industries, the instructors continue their work in the province and also in other countries of the Indo-Chinese Union (Cambodia, Cochin-China, Annam).

All Indo-China is wonderfully well suited to the development of the silk industry. A large market for the products is assured as raw silk materials have taken first place among the exports of the Far-East to France and woven silk materials are the most important exports of France. The

export of raw and woven silk to France did not exist about ten years ago; now its value exceeds 1 million francs (£39 649) for Tonkin and ½ million for Annam. Some Chinese merchants export native silks and silk waste to Hong-Kong, Malaya and Siam. This trade has decreased greatly in Tonkin and Annam, but is still flourishing in Cambodia and Cochin-China. It is to be hoped that it may be completely replaced by an industry exporting all its products to France.

## FISH CULTURE

**1265 — Complementary Notes on Fish Breeding in Rice Fields, in Madagascar.** — LEGENDRE, J., in the *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year III, No. 19, pp. 227-228. Tananarive, 1918.

Further advice is given (1) on the breeding of carp in rice fields, recommended both as a source of extra food for the natives and as a means of destroying mosquito larvae which live in the irrigated crop and transmit malaria (2). The carp are put in the rice fields eight days after transplanting if possible, and, at any rate, as soon as the water is there permanently. The depth of water most favourable to the growth both of the rice and the carp is from 3 to 6 inches. If the fish are about 3 inches long, two should be placed per square metre (1.19 sq. yards), if they are smaller, four or six per square metre. It is wise to put in some 2-inch long fish as these have reached the age for reproduction and may spawn in the rice fields (spawning in September, October and November).

To keep the fish in the field the holes by which the water enters and leaves it must be covered with wicker-work made with branches 0.04 to 0.08 inches apart, either crossed, or arranged parallelly and vertically and joined transversally. After the harvest the fish are collected, the largest (at least 3 inches without the tail) eaten and the rest placed in a reservoir till the next rice season. This reservoir may be a hole dug in the soil capable of holding at least 11 lb. of carp per cubic metre (1.30 cubic yards) of water, but a small pond is preferable. The fry feed on the aquatic animalcules, which the larger fish of the rice fields refuse, so that the fish production of the field is increased.

The author estimates that a well-stocked rice field should yield in four or five months ten-times the weight of fish it received.

**1266 — The Fennec Fox in Captivity to Replace the Domestic Cat.** — CRÉPIN, P., in the *Bulletin de la Société Nationale d'Acclimatation de France*, Year LXV, No. 8, pp. 225-228. Paris, August 18, 1918.

The fennec fox (*Canis zerda*), so little known at present, is of a certain interest. This pretty little North-African fox is easily tamed and, though it is not common, would be of great service to agriculture could it be reared.

It destroys cockchafers, locusts and crickets, all kinds of injurious insects, rats, it is as clean as the cat, requiring no previous training;

(1) See R. May, 1917, No. 472. (Ed.).

(2) To control malaria the breeding of other species has also been recommended, amongst them *Gambusia affinis*, a hardy, tiny fish, doing well in shallow water and in ponds containing less than 1.14 inches of water. See R. March, 1918, No. 251. (Ed.)



it takes up little space, does not smell, eats almost any thing, destroys less small birds than the cat, for it cannot climb trees, and is a pleasant companion, with a fine coat. It might well replace the cat as it has more advantages without the serious defects of the latter.

## [FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

1267 - Trials of Machines for Cultivating Vineyards Organised at Montpellier and Roche-de-Brun, France, in 1918. — I. FERROUILLAT (Director of the National School of Agriculture at Montpellier), in *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 25, pp. 6-7. Paris, June 18, 1918. — II. CASTEX (Director of the Vienne Agricultural Department), *Ibid.*, Year XXIII, No. 30, pp. 3-4. Paris, July 23, 1918.

1. — The trials took place in May in a vineyard on the Rochet estate, near Montpellier, in an easy, sandy soil in perfect condition. Part of the vines are planted about 50 in. apart in the lines, which are 6 ft. 6 in. apart; there are headlands from 13 to 16 ft. wide at each end and the rows are from 812 to 1 000 ft long, thus providing favourable working conditions for tractors.

The CHAPRON TRACTOR (1), which took part, was tried with a small 3-furrow OLIVER plough working a width of 28 in. and a spring tine Canadian harrow covering a width of 59 in. While there M. CHAPRON designed a machine capable of cultivating the whole space between the lines (69 in.), which consisted of a triangular frame, in the centre of which in front was fixed a drill plough, while 3 small AUBERT ploughs (Montpellier) were fixed on each side like stubble ploughs, thus making 7 working parts in all. Although not quite successful, after a slight modification the machine improvised in this way did not work badly.

The tractor, tried with the 3 machines mentioned, worked perfectly and did no damage whatever to the vines. The last day was employed in dynamometric and fuel-consumption tests. The results, given in a table, show that the tractive effort per sq. decimetre (= 1.55 sq. in.) of section of the strip of earth worked is very low (60.7 lb. with the Oliver 3-furrow plough working 6 in. deep. and 57.8 lb. with the same ploughing at a depth of 5 in.; 32.8 lb. with the CHAPRON gang-plough working at 2 to 3 in. deep, and 46 lb. with the same plough loaded with 297 lb. and ploughing 5 in. deep; 45.3 lb. with the Canadian harrow working at 4 in. deep. As the soil was sandy, the surface layer was perfectly broken down. Occasionally the tractive effort attained high figures, but without decreasing the speed of the machine, thus showing that its limit of traction was much higher.

As regards fuel consumption, in a first trial, an engine standing still while running at 1400 revolutions per minute consumed 0.44 galls. of petrol (density: 0.730) per hour; in 2 other trials the tractor, towing the 3-

(2) See R., October, 1918, No 1145. (Ed.)

furrow OLIVER plough and ploughing 5 in. deep in the one and 7 in. in the other (in relation to 28 and 32 in. of width and furrow lengths of 934.3 and 959 ft.) consumed 4.18 galls. in the first trial and 4.65 galls. in the second, which corresponds to 1.18 and 1.50 galls per acre of vineyard.

In the first trial the speed was 1.86 miles and in the second 2.37 miles. The time theoretically required to plough 1 acre of vineyard was 94 minutes in the first case and 70 minutes in the second ; in practice  $\frac{1}{3}$  more is needed, giving 125 and 93 minutes respectively.

The author observes that the fuel consumption of the engine is neither the only nor most important factor in judging the value of a tractor. The essential is to have a well-built strong machine with parts of easy access and maintenance, even if it does consume more petrol than another machine. Moreover, the fuel consumption varies from one machine to another and depends, in a certain degree, on the skill of the driver.

The CHAPRON tractor has a low fuel consumption and has some good points in its construction. The author thinks, without giving a final opinion, that the tractor seems suitable for viticultural work and is well worth note.

II. — Eleven makers had entered in June for the tests at La Roche-De-Bran (Vienne), but, owing to transport difficulties only 7 machines actually took part.

The Roche-de-Bran estate vineyard has a marly, slightly stony soil which is in very good condition. The vines are planted in rows 6 ft. 6 in. apart. Part of the vines are trained on iron wire. The branches are attached to the pole that supports each plant ; the long branches are propped between the plants in the direction of the lines, which increases the difficulty of mechanical cultivation. The lines are 600 ft. long and the headlands are 13 ft. wide. Plots of about 5 acres each were numbered and allotted, by drawing lots, to each the makers taking part in the trials.

In 1917, only two foreign-made machines for the mechanical culture of vineyards took part in the Mettray (1) trials ; at La Roche-de-Bran 4 French makers showed quite new types of machines, which show certain progress in adapting the tractor to vineyard cultivation. The author recalls that in order to plough 4 to 6 in. deep and scarify 2 in. deep in hill or plain vineyards, M. RINGELMANN, in his report on the mechanical cultivation of vineyards (2), estimates that the machine should have a maximum width of 3 ft. 3 in., while the tractor and the machine it hauls (plough or cultivator) should be able to turn on a headland no wider than 10 ft., the total weight of the machines not being greater than 2420 lb. These tractors should also be utilisable for sulphating, sulphuring and road transport. In addition when hoeing and weeding drilled crops it is necessary that the distance between the front wheels and the back wheels can be modified so as suit the width of the drills. The outer edges of the tyres should be about 8 in. from the axis of the seed-bed or of the plantation to be hoed or weeded.

Amongst the machines tested the author describes ; —

(1) See R., 1917, No. 940. (Ed.). — (2) See R., 1917, No. 841. (Ed.)

1) the 12-20 H.P. Cleveland (1), chain-track tractor, presented by the ALLIED MACHINERY Co. of France, 19, rue de Rocroy, Paris.

2) The tractor entered by the AMERICAN TRACTOR Co., 11 and 13, avenue du Bel Air, Paris.

3) the CHAPRON tractor (2) which ploughed and scarified the vineyard as well as ploughing 8 in. deep with a 2-furrow plough in ordinary soil and hauled with ease a mower for cutting hay in a meadow.

4) the vineyard tractor of the COMPTOIR ANGLO-FRANCO-RUSSE, 19, Avenue de l'Opera, Paris; 4 HP. at the pulley and 1.25 HP. at the draw-bar; runs at 230 to 2000 revolutions per minute, 0.93 and 3.1 miles per hour on the road, 0.6 to 1.8 miles on ploughed land; weight 451 lb.; height 3 ft. 3 in. This machine hauled a machine-hoe that hoed and weeded in two successive turns on the same strip.

5) the tractor entered by MM. F. GROS & BOUCHARDY fitted with a 10 HP. DESSAULES engine, running on paraffin or petrol.

6) the PAX motorplough of MM. FRANFORT & SEGUIN, 144, Rue de Charonne, Paris. The 2-cylinder vertical 6-8 HP. engine of this tractor runs at 800 revolutions and is placed in front of the axle; the makers state that it requires 3.3 galls. of petrol and 4.4 lb. of oil per day. The tractor is guided by means of 2 stilts placed behind the frame. Its total width is 3 ft. 3 in., its length is 10 ft. 6 in. and its height 3 ft. 3 in.; it weighs 1650 lb.

7) the No. 1 "Simplex Viticultural" tractor of SCHWERTZER & Co., 86, rue de Flandre, Paris, is built especially for cultivating vineyards; it is only 2 ft. 9 in. broad, as that it can easily pass amongst the rows of vines. The machine hauled a Canadian harrow and a vineyard plough. The implements hauled can be controlled directly by the driver without him having to leave his seat. The 4-cylinder, 10 HP. engine has 2 speeds and its single reverse runs at 2.5 to 3.1 miles per hour; the two driving wheels are braked separately. The tractor weighs 1540 lb. and it is 8 ft. 3 in. long; its declared fuel consumption is 0.88 to 1.1 galls. of petrol per hour.

All these machines worked well during the test period, without damaging the vines in spite of the difficulty resulting from the fact the long branches were supported over the soil and might have been caught by the working parts in passing.

**1268 - Tractor Operating Data in the U. S. A.** — *Official Report of the University of Illinois, Division of Farm Mechanics, in The Implement and Machinery Review, Vol. XLIV, No. 520, p. 412. London, August 1, 1918.*

Early in 1917 the Division of Farm Mechanics, the University of Illinois, U. S. A., sent to 60 tractor operators in the State of Illinois record sheets, arranged for the purpose of enabling the farmer to keep a yearly record of his tractor operations. When returned, 22 reports were found to have been carefully kept. A summary of the data obtained is given in the appended table. It should be remembered that these data have been ob-

(1) See R., October, 1918, No. 1145. (Ed.) — (2) See R., October, 1918, No. 1145. (Ed.)

tained from a limited number of successful operators. In only one case (tractors with kerosene-burning motors pulling 3 ploughs) is the number of operators large enough to warrant the drawing of general conclusions.

*Summary of tractor-operating data, Illinois, 1917.*

Fuel used	Gas	Gas	Kerosene	Gas	Gas
Operators reporting . . . . .	2	4	14	1	1
No. bottoms on plough used . . . .	2	3	3	5	6
Original cost of tractor . . . . . \$	827.50	1041	797.57	20.20	2 610
Years since purchase . . . . .	1.5	2.51	1.96	4.5	2
Different days used . . . . .	32.5	37.25	42.41	58	33
Hours used . . . . .	219	264.25	293.14	363.5	302.5
Hours trouble . . . . .	6	17	16.29	6.25	4.75
Percent time-trouble . . . . .	2.74	6.43	5.55	1.72	1.57
Fuel cost . . . . . \$	80.50	109.54	60.28	260.30	360.55
Lubricants cost, . . . . .	20.45	18.08	19.45	35.53	15.51
Repair cost . . . . .	4.55	43.15	38.16	36.33	2.50
Miscellaneous cost . . . . .	4.85	4.57	7.54	20.44	6.95
Operating cost per season, . . . .	110.35	175.34	125.43	352.60	385.51
Depreciation, 20 % . . . . .	165.50	208.25	159.51	404.00	522.00
Interest . . . . .	29.79	37.8	28.71	72.72	93.96
Total cost per year, . . . . .	305.64	421.07	313.65	829.32	1 001.47
Percent repair cost of original cost . .	0.55	4.14	4.78	1.80	0.096
Acres in farm . . . . .	238	240	258.57	271	675
Acres cropped . . . . .	202	199.75	213.63	200	675
Acres maize . . . . .	131.5	84.5	89.13	60	297
Acres oats . . . . .	70.5	52.5	66.25	110	120
Acres wheat . . . . .	—	10.0	17.30	—	—
Acres hay . . . . .	—	42.75	35.93	—	258
Acres miscellaneous, . . . . .	—	10.00	5.28	—	—
Horses used before tractor was purchased	11.5	7.0	9.5	18	24
Horses used after tractor was purchased.	8	5.0	7.35	18	12
Horses displaced . . . . .	3.5	2.0	2.15	—	12
Gallons gasoline . . . . .	407	527.25	43.8	1 265.5	1 765
Gallons kerosine . . . . .	—	—	548.5	—	—
Gallons fuel per hour: . . . . .	1.86	1.995	2.02	3.48	5.83
Cost gasoline per gallons, cents . . . .	19.7	20.77	20.44	20.56	20.42
			9.34		

**SIZE OF TRACTORS.**— One tractor was of 6-12 H.P., 4 were of 8-16 H.P., 9 of 10-20 H.P., 6 of 12-25 H.P., 1 of 20-40 H.P., and 1 was of 25-40 H.P. Three of the users of 8-16 H.P. machines desired a larger tractor; 3 users of the 10-20 tractors believed that a larger machine would be better adapted to their conditions; only 2 men, one using a 10-20 and the other a 20-40 desired a smaller machine.

**TYPES OF DRIVE.**— 21 machines had wheel drives and 1 had a caterpillar type of drive. Sixteen of the 21 wheel machines had 2 drive wheels. Of the 5 operators whose machines had other than the 2-wheel drive, 3 expressed preference for a 4-wheeled machine with 2 drivers.

**Hired Help.** — The hired help bill was reduced by 10 farmers. The amount of reduction reported varied from  $\frac{1}{3}$  to  $\frac{2}{3}$  of the previous help bill. One farmer operating 320 acres reported that he had been able to dispense entirely with the services of one man.

**Soil Packing.** — 10 operators reported no soil packing; 6 reported packing when the soil was wet; 2 reported packing of maize ground; 3 reported beneficial effects from packing, and one made no report on this question.

**Price of Tractors.** — Practically all the machines were purchased at pre-war prices. To-day the same machines would cost from 60 % to 100 % more, which would materially increase the depreciation charge.

**Trouble.** — The % time-trouble is obtained by dividing the hours trouble by the hours used and multiplying by 100. The relatively large % time-trouble reported for gasoline tractors pulling 3 ploughs is due almost entirely to one operator who used a tractor having a 2-stroke cycle motor. Omitting the report of this man the % time-trouble for this class of machine is 4.15.

**Depreciation.** — The annual depreciation is estimated at 20 % of the original cost of the tractor.

**Interest.** — The interest (6 % per annum) is thus estimated: — Add the original cost and the annual depreciation; divide this sum by 2; and multiply the quotient by 0.06.

**Horses.** — Fifteen of the 22 operators replaced one horse or more by the use of the tractor. These data indicate that on the average a man farms 22 crop acres per horse without the use of a tractor and 29.7 crop acres per horse when the tractor is used. Nine operators stated that the tractor enabled them to use either lighter horses, more brood mares or young horses.

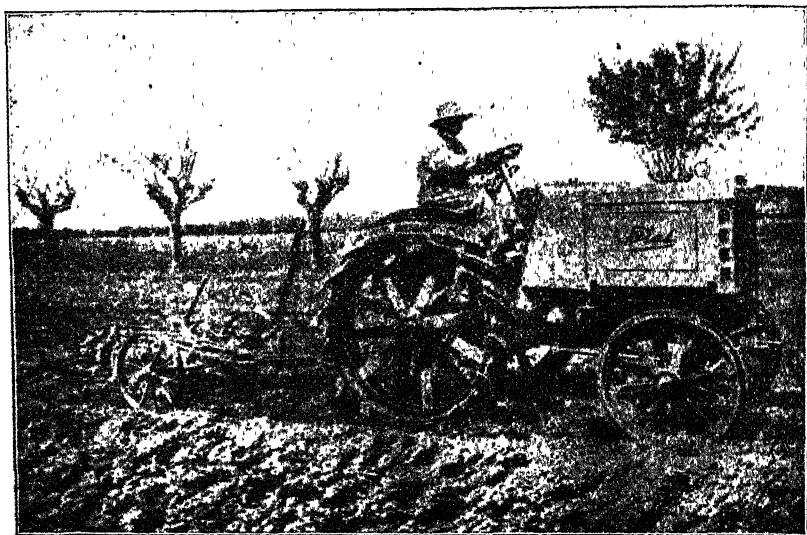
**1269 — The "Fiat" Tractor.** — SIGNORINI, M., in *Il Coltivatore*, Year LXIV, No. 24, pp. 503-504 + 1 Fig. Casale Monferrato, August 30, 1918.

The Italian-made "Fiat" tractor was tested successfully on August 21, 1918 at the Marchesa farm near Turin.

This tractor, shown in the appended figure, is of 18-20 H.P.; the engine has 4 cylinders (100 × 180) and it has 3 speeds — 1.4, 3.1 and 3.7 miles per hour; it weighs 5280 lb. and has a draw bar pull of 3960 lb. in the first speed and 2200 lb. in the second; it is 53 in. wide. Towing a 3-furrow plough at 8 in. deep it can plough 64 584 sq. ft. per hour, consuming 19.8 lb. of paraffin. This tractor can be used for towing vehicles on the road as well as for hauling machines for cultivation and for gathering crops. In addition, by means of a pulley, the "Fiat" tractor can be used to drive threshers and fixed farm machinery.

According to the author, the "Fiat" tractor has been built to meet the needs of Italian agriculture; it is strongly made, easily handled and smooth running; it suits large and medium sized farms.

The price of the tractor is not yet fixed, but it will not cost more than the foreign tractors imported into Italy.



"Fiat" tractor at work.

1270 - **The Haulage of Ploughs.** — RINGELMANN, M., in the *Comptes Rendus de l'Académie d'Agriculture de France*, Vol. IV, No. 27, pp. 746-748. Paris, July 24, 1918.

The author has previously shown that ploughing requires 80 % of the total energy necessary for cultivation.

Suitable weather for ploughing is generally limited in extent. Ploughing is not done under good conditions unless the soil contains from 9 to 10 % of water, 11 to 17 % being considered the optimum; at more than 21 or 22 % of water, the ploughing becomes bad. The water content of the soil, apart from the purely cultural point of view, has an influence on the wear of the parts, on the stability of the machine and, above all, on the tractive effort required by the plough.

As regards wear, in a good light potato soil (tertiary soil of the Grigny Plateau, Seine-et-Oise, France), the ploughshare has to be set 6 or 7 times per acre in dry summer weather. Each setting cost about 7*d.*, working out at 3*s.*6*d.* to 4*s.*1*d.* per acre. In September, when the soil is wet by the rains, one setting suffices for about 3 <sup>3</sup>/<sub>4</sub> acres. Under the conditions of the present case one share is completely worn out after ploughing 44.5 acres and to replace it costs 6*s.* 3*d.* for ordinary steel and 10*s.* 5*d.* for hardened steel.

. The tractive effort per sq. decimetre of section ploughed increases

[1269-1270]

for the same plough in the same soil in measure as the soil dries (the average density is 2 304 in tertiary soil).

The tractive effort for the plough at different dates and for ploughings comparable one with the other as regards dimensions was 47 kg. per sq. decimetre for a soil water-content of 15.4 %; 46.1 kg. for 11.1 % of water; 70.7 kg. for 5.1 % of water; and 78.2 kg. for 3.8 % of water.

The shape of the working parts also influences considerably on the traction. Thus, on the same length, at an interval of half an hour, a plough requires, for the same ploughing, from 1.40 to 1.42 times the pull required by a model of better design or more suited to that particular soil.

As the periods during which the soil are in such a state of humidity as to work well are generally limited, power farming has the advantage that, with it, the farmer can work his land in the desired time.

**1271 - A Tractor Plough.** — DESSAISATX, R., in the *Journal d'Agriculture Pratique*, Year LXXXII, Vol. XXXI. No. 17, pp. 329-330 + 1 Fig. Paris, August 22, 1918.

When a vehicle moves up a slope its resistance increases with the steepness of the slope. The motor drawing the vehicle up the slope uses a certain amount of energy to move itself, so that there is a reduction of the amount of tractive energy available for the vehicle or machine to be towed. This loss is due to the elevation of the motor on the inclined plane and is independent of the nature of the motor. For example, a tractor weighing 6160 lb. which gives an actual pull of 1672 lb. on level ground, and hauling a plough requiring an average tractive effort of 440 lb. per furrow, will give a pull of 1320 lb. for 3 furrows and 880 lb. for 2 furrows on level ground.

If this tractor mounts a 10 % slope, its possible tractive effort drops to 1661 lb. owing to the decreased pressure of the driving wheels on the soil, and the tractor itself requires 616 lb., so that if it gives a pull of 1672 lb. on level ground, it can only give a pull of 1045 lb. when mounting, which is insufficient for opening 3 furrows, but more than sufficient for opening 2 furrows. The tractor must, therefore, be handled in such a way that, in ascending, only 2 furrows are opened, while, in descending, 3 furrows are opened at the same time.

Therefore tractor ploughs destined for use in steeply sloping land should be arranged in such a way that, by moving a simple lever, the number of plough bottoms working could be rapidly changed.

MM. DE LACOUR and FABRE, 4, Avenue de Villiers, Paris, have exhibited at the Noisy-le-Grand (France) official trials a GALLOWAY plough (1) built according to the principle described above. It is a 3-furrow plough, and, for slopes, the third plough can be raised by moving a lever, when only 2 furrows are ploughed.

In considering the application of mechanical cultivation to the uneven ground in Scotland, the Highland and Agricultural Society of Scotland had laid down the condition (2) that ploughs intended to work on hilly ground should be made in such a way that they could be quickly changed at the

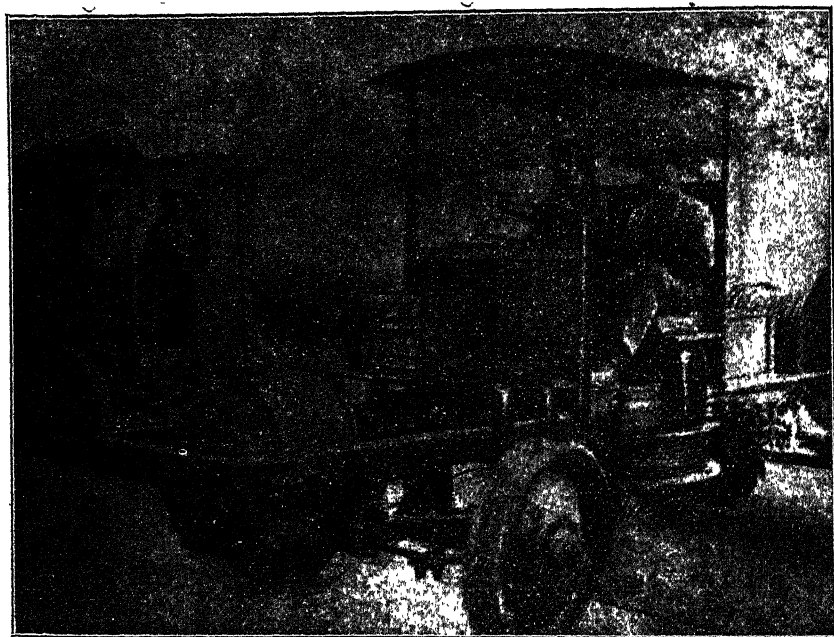
(1) See R., Oct. 1918, No. 1145. (Ed.) — (2) See R., Feb. 1918, No. 199. (Ed.)

end of the furrow so as to plough 2 or 3 furrows according to whether the tractor ascended or descends the sloping field.

The GALLOWAY plough fulfills the condition, which is applicable to so much cultivated ground.

1272 — The Béfort and Gaillard Electric Ploughing Set. — *Le Génie Rural*, Year X, No. 83, p. 14 + 2 Figs. Paris, 1918.

In this system — now on trial near Paris — the electric current does not come from a section but from a generator forming part of the set. The makers thus use electricity as a mechanical organ acting at the point where



Generator.

Front view of windlass.

it is required, and give that organ all the independence of the other organs forming the set. They are thus able, just as with a petrol engine and with just as much freedom, to generate the power at the required place and when required.

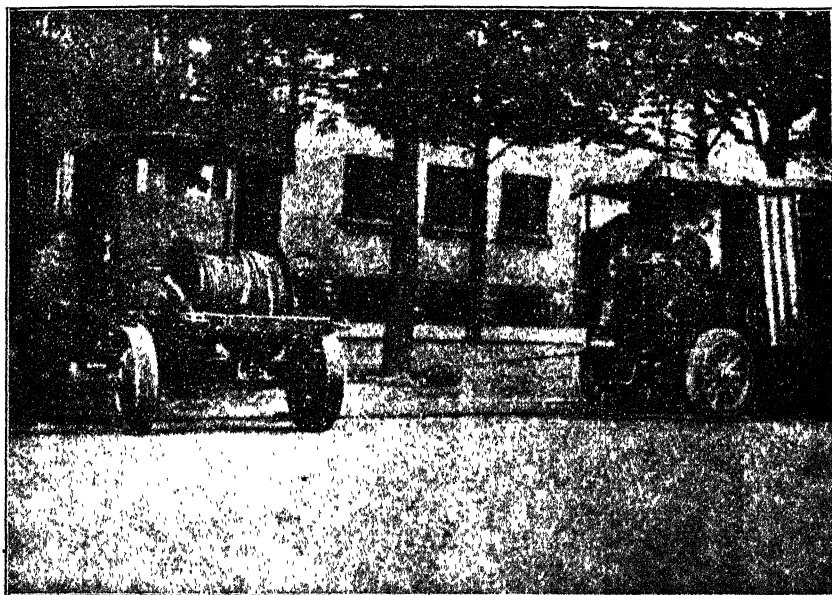
By transforming the initial power into auxiliary current, the makers claim that the power actually available is much greater than the same power used as a tractor in direct traction.

The BÉFORT-GAILLARD system, using a single generator with a minimum cost, has the advantage of always giving direct traction, the generator serving equally as tractor for the set, and all the ploughs of the farm.



The set offered to the French Ministry of Agriculture consists of a steam-generator, working very smoothly and easily controlled. The generator is always supplied with water and coal for a 10 hour's run, *i. e.* for 1 day's work without further supplies. It thus forms a mobile station going where wanted, when it has to supply its 2 sub-stations.

Cable-ploughing sets with a single generator all require a return cable



Rear view of windlass.

Generator.

or a return pulley. By doing away with the return pulley MM. BÉFORT and GAILLARD obtain a yield of 86 % of energy available at the draw bar.

To provide for unforeseen resistances and all the strains of traction, a good amount of reserve power must be available. At a speed of 85 cm. per second — a good practical speed for all hard work — the tractive effort is 1800 kg. Taking as basis a 5-furrow balance plough working at a depth of 20 cm. and meeting a resistance of 55 kg. per sq. decimetre, the tractive effort is not over 900 kg.; the reserve power is thus amply sufficient meet all possible needs.

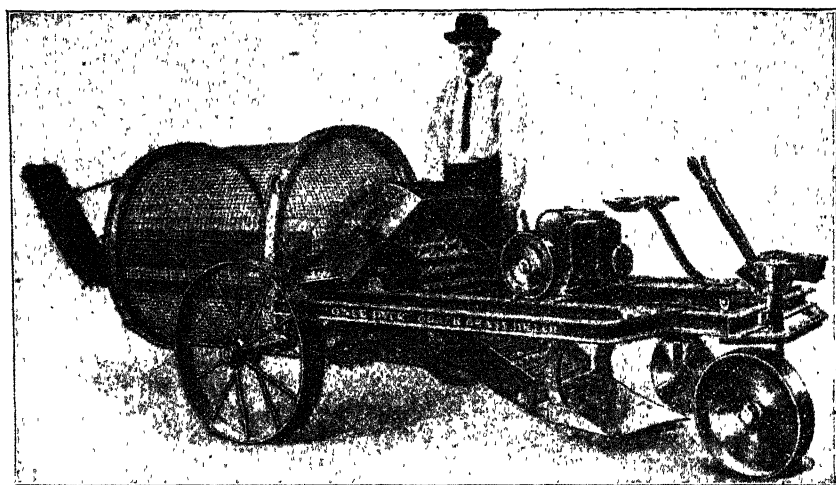
The BÉFORT and GAILLARD set have the following interesting characteristics: — front swingle-trees with automatic decentring, so that cable traction can be used (without an auxiliary return of the cable) for drilled crops; a draw-bar hook buffering and controlling the traction.

1273 - The "Once-Over" Quack Grass Killer. — *The Implement and Machinery Review*, Vol. XLIV, No. 520, pp. 415-416 + 1 Fig. London, August 1, 1918.

The QUACK GRASS EXTERMINATOR Co., 912, Andrus Building, Minneapolis, Minn., U. S. A., makes a new machine for exterminating weeds, particularly couch grass. By running this machine once over a field (whence its name), practically every vestige of crop-killing weed is said to be exterminated.

This new device, shown in the appended figure, resembles a tractor, but does not propel itself. Its petrol motor serves to operate the mechanism while the machine itself is hitched to a tractor or drawn by horses.

The machine consists of a framework mounted on wheels, carrying at its forward end an ordinary plough, minus the mould board, behind which



"Once-Over" quack grass killer.

is a toothed cylinder, followed in the rear by an elevator running backward and upward at an angle of about  $40^{\circ}$  into separating mechanism, which, in turn, is followed by a large circular sieve moving in an anti-clock direction as the machine travels forward. Inside the reel or sieve is a horizontal conveyor running to a perpendicular elevator swing in the rear of the machine for conveying the weed refuse into a wagon driven alongside.

The operation of the machine can be described as follows:— The plough share located at the forward end is 16 in. wide and set to run at a depth of 4 to 6 in.; the ribbon of soil cut is passed back, there being no mould board, and brought into contact with the teeth of the forward cylinder which cuts and shreds up the weeds and soil. At this point about 60 % of the soil is returned to the earth and the weeds, stalks, etc., are elevated into the separating machinery, where a system of separation, not unlike that of a

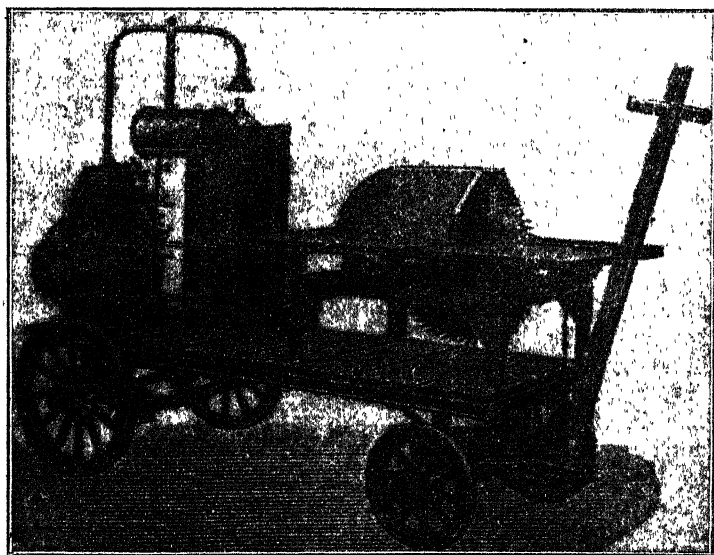
wheat or small grain threshing outfit, separates the weeds and 20 % of the soil, the latter being returned to the ground. All the weeds and roots and the remaining 20 % of the soil pass into the revolving sieve in the rear. The soil is completely lost through the meshes of this sieve, and the weeds are carried upward by the revolving screen and dumped into the horizontal conveyor, in which they are carried to the perpendicular elevator in the rear, where they are elevated into a vehicle to be carted away and burned, or otherwise destroyed.

A field is thus left in a condition free from all weeds, roots and other noxious growths and in a thoroughly tilled condition, ready to be sown at once if desired. The machine has a capacity of 3 to 5 acres per day, according to the nature of the soil, the thickness of the ground and the speed at which the machine is towed.

This new tool is said to be strongly made and should last from 5 to 8 years; its estimated cost is £ 200.

1274 **Motor-saw Mounted on a Hand-cart.** — *La Terre Vaudoise*, Year X, No. 27, p. 249 + 1 Fig. Lausanne, July 6, 1918.

Messrs MEGEVET of Geneva make a circular motor-saw for cutting fire wood; the saw is driven by a petrol motor, the whole being mounted on a small hand-cart.



MEGEVET motor-saw mounted on a hand-cart.

The motor is of the FÉLIX-MEGEVET type; it is simple, light and runs well. By adding another cylinder, the maker has improved on the old, one-

cylinder type. As is shown in the figure the MEGEVEY wood-sawing plant is completely independent and can be moved and set up anywhere in the forest or at the farm. Its small size enables it to pass easily into restricted spaces. Its easy transport and use gives it a claim for superiority over other systems.

The circular saw, with its roller-table and well protected blade, is very safe and easy to work. The engine drives directly on the shaft of the circular saw by means of a horizontal belt. The whole plant is strongly built and all the parts are easily accessible.

The engine consumes little petrol. By using this motor saw (1), great economy in labour can be made while the work is done more quickly.

**1275—The Marmier and Canonne Apparatus for Drying and Concentrating Liquids at Low Temperatures.** — MARMIER, L. (Assistant Director of the Pasteur Institute at Lille), in the *Annales de l'Institut Pasteur*, Year XXXII, No. 4, pp. 145-149 + 2 Figs. Paris, April, 1918.

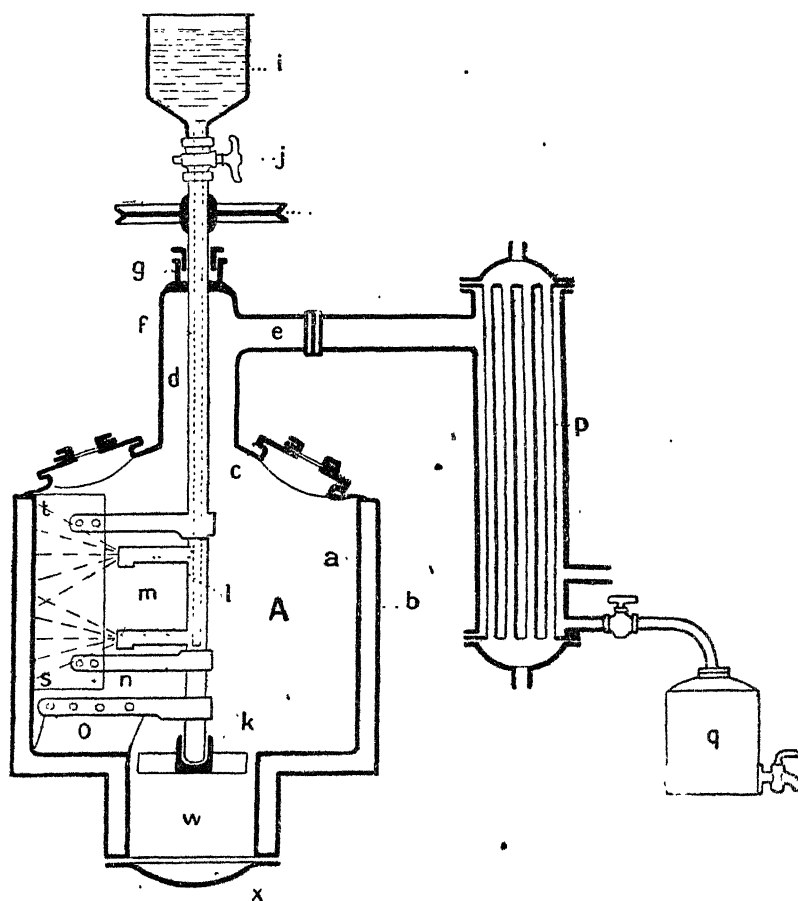
Many liquids of organic origin, such as albumin, fresh grape must, milk, etc., can be kept a long time without any fermentation taking place if they are dried or even when sufficiently concentrated. To do this, they cannot be boiled at atmospheric pressure and often they cannot be heated to about 60°C without running the risk of changes taking place in their composition. To enable such liquids to be dried or concentrated at low temperatures while retaining all their properties MM. MARMIER and CANONNE have designed an apparatus (see Fig.) which is constructed as follows:—

The desiccator consists of a closed cylindrical boiler *A* with double walls *a* and *b* between which circulates hot water maintained at the required temperature. The upper wall *c* has an outlet tube *d* communicating by a pipe *e* with a condenser *p*; this would be, for example, a tubular condenser whose tubes are water-cooled internally. The steam given off in *A* condenses on the outside of the tubes and the liquid thus obtained is collected in a tank *q*. A vacuum pump maintains a suitable vacuum throughout the apparatus. The liquid to be treated, coming from a recipient *i*, having the tap *j*, is distributed through the boiler by means of a hollow shaft *f* traversing the gland *g* and rotated by the pulley *h* or a cog-wheel.

Several radial tubes *l*, fixed on the shaft and communicating with the hollow interior, end in a nozzle *m* spraying the liquid in a fine spray on the chamber walls *a*. A scraper *s*, carried by the arms *n*, is mounted on the shaft which carries it round when rotating. It touches the cylinder walls, removing the concentrated or dried liquid deposited on the walls by the spray. A second scraper *o* is placed at the lower part of the shaft, and is so placed as to bring the dried product into a recipient *w*, from which it is removed at the end of the operation by the plug *x*. The apparatus works in the following manner:—

(1) The motor-saw with 1-cylinder, 3-H.P. FÉLIX engine costs 2900 Swiss francs; that with a 2-cylinder 6-H.P. FÉLIX engine costs 3500 Swiss francs. (Ed.)

When the water-bath is at a suitable temperature, the tap *j* is closed, and a vacuum produced. The reservoir *i* is filled with the product to be dried or concentrated; the shaft is set turning, *j* is opened; the atmospheric



MARMIER & CANONNE apparatus for drying liquids at low temperatures, Section.

pressure forces the liquid into the hollow shaft and into the jets. The liquid is spread in a thin layer on the heated wall and quickly evaporates. The rate of spraying and the speed of rotation are regulated in such a way that the product deposited on the wall is dried or concentrated to the

required degree before the spray passes again. The scraper *st* removes the product, which falls to the bottom and is scraped into the recipient *w* by the scraper *o*.

For small flows, jets with very fine holes are used. As there is a certain minimum size, especially for viscous liquids or those containing solids in suspension, beyond which the jets become stopped up, a sufficiently large opening is used and, by means of a very simple mechanism fixed to the apparatus, the movement of the shaft and the arrival of the liquid are stopped once every revolution, the liquid being stopped just a little before the shaft. After a time sufficient for the product to evaporate, the mechanism sets the shaft in motion for a second revolution and allows the liquid to pass once more. Whether the apparatus works continuously or discontinuously, the final product is always exactly the same for the same temperature and degree of vacuum in the desiccator.

With this machine the author was able to concentrate large quantities of fresh grape must which have kept perfectly, without any previous sterilisation, for several years. It should be noted that owing to the intense evaporation of the liquid, the product treated is at a much lower temperature—about 20° to 26°C—while on the wall than the wall itself—36° to 45°C.

1276 — **The Eichenberger Electric Evaporator.** — AMSTEIN, J., in the *Schweizerische Obst und Gartenbau Zeitung*, Year XXXI, No. 18, pp. 221-222 + 2 Figs. Münsingen, August 1, 1918.

Since 1917, M. E. EICHENBERGER, of Neukirch-Egnach, canton of Thurgovie, Switzerland, has made an electric evaporator for drying fruit, vegetables and other agricultural products, which has worked successfully for a year.

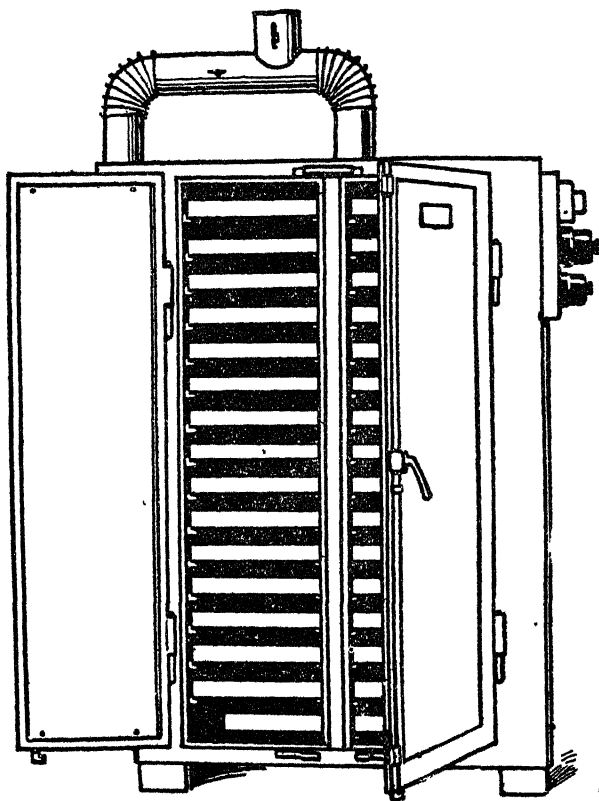
As is shown in the figure the EICHENBERGER electric evaporator is shaped like a wooden cupboard insulated with eternit and fitted with a ventilating fan driven by a weak electric current; the bottom and walls are provided with heating elements and a heat regulator.

This evaporator is made in different sizes; the small models are in 3 sizes from 32 to 59 in. high; the model *a*, of 200 to 300 watts, can take from 6.6 to 14.2 lb. of material to be dried; model *b*, of 300 to 400 watts, can take from 14.2 to 22 lb.; model *c*, of 400 to 700 watts, from 22 to 40 lb. Their prices are 90 fr., 100 fr., and 150 fr. respectively. According to the size they take up to 16 trays.

The evaporator used by the author is the largest model, costing 1500 fr.; as shown in the figure, it contains 32 trays holding 264 lb. of apples or 154 to 220 lb. of vegetables. According to the product, from 7 to 24 hours are required to obtain the desired degree of dryness.

The author used the apparatus continuously day and night from September, 1917, to February, 1918 and later on for another 3 weeks. During all this time he dried 6600 lb. of apples, 660 lb. of prunes and from

15 200 to 17 600 lb. of various products. — french beans, celery, turnips, parsley, etc.



EICHENBERGER electric evaporator.

#### 1277 - Review of Patents.

TILLAGE MACHINES AND IMPLEMENTS. — *Brasil*: 10217 Three furrow plough; 10218 Ridge plough for cereal cultivation.

*Canada*: 183565 Disc harrow; 183670 Harrow lifter.

*France*: 487948 Combined cultivator and hoe replacing the plough and other implements; 488287 Device for utilising Brabant and balance ploughs for motor culture by combining them with light engines; 488309 Improvements to gang ploughs towed by cable.

*New Zealand*: 39192 Harrow; 39561 Subsoil-draining attachment for agricultural implement.

*Sweden* : 43134 Agricultural implement.

*United Kingdom* : 117140 Soil pulverising machine ; 117150 Coupling for motor-plough ; 117169 Balance plough ; 117660-117661 Ploughs and cultivators for attachment to 2-wheeled motor-tractors ; 117766 Lifting device for ploughs or cultivators drawn by motor tractors ; 117771 Wheeled carriage for receiving beams of plough shares or cultivator lines and for attachment to a motor-tractor ; 117856 Power cultivation of land by cables.

*United States* : 1271031 Lister plough ; 1271373 Plough ; 1271485 Dumping scraper ; 1271818-1272231 Rotary spaders ; 1272260-1272294 Harrows ; 1272905 Tractor plough ; 1273069 Spring governor hitch for plough.

DRAINAGE AND IRRIGATION. — *Sweden* : 43242 Ditching machine.

*United States* : 1273206 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Denmark* : 23289 Fertiliser distributor.

*United States* : 1270849-1271007 Fertiliser dropping device.

DRILLS AND SEEDING MACHINES. — *Canada* : 183902 Potato planter.

*United States* : 1272550-1273251 Planters ; 1273039 Potato cutting machine.

VARIOUS CULTURAL OPERATIONS. — *Canada* : 183993 Plant protector.

*Denmark* : 23310 Movable spring-tines for cultivator, horse-hoe, etc.

*France* : 488320 Orchard plough.

*United Kingdom* : 117548 Stake for supporting plants.

*United States* : 1270787-1273496 Wheel weeder hoes ; 1270802 Riding cultivator ; 1271292 Lister cultivator ; 1271882 Attachment for maize cultivator ; 1272567 Hand cultivator.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *New-Zealand* : 40019 Garden spraying apparatus.

*Switzerland* : 79035 Cockchafer trap.

*United States* : 1270847 Boll weevil catcher ; 1271355 Insect trap ; 1271504 Palmetto-root and weed plough.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada* : 183747 Basket for lawn mowers.

*Denmark* : 23159 Platform for binders.

*France* : 488234 Motor lawn mower.

*Switzerland* : 78915 Mower knife control mechanism ; 79032 Sheaf packer and binder.

*United Kingdom* : 117137 Fruit gathering device ; 117496 Improvement to side-delivery hay-raking and swath-turning machines.

*United States* : 1271705 Bean harvester ; 1271803-127867 Harvesters ; 1271845 Header attachment for tractor ; 1272007 Bundle-carrier for grain binders ; 1272095 Sickle attachment ; 1272140 Grain saving attachment for binder ; 1272360 Automatic trip for shocking machine ; 1272371 Kaffir-corn header ; 1272426 Shocker attachment for binders ; 1272617 Hay-rake for mechanical traction ; 1272628 Mower and harvester attachment ; 1272665 Grain-reclaimer ; 1272666 Mechanical hay shocker ; 1272711 Cord holder for grain binder ; 1272717 Seed harvesting machine ; 1272733-1273350



Maize picking and husking machines ; 1272875 Flax pulling attachment for harvesters ; 1272885 Attachment for hay rake ; 1273240 Maize stalk cutter and loader.

**MACHINES FOR LIFTING ROOT CROPS.** — *Denmark* : 23223-23307-23325-23326 Potato diggers ; 23250 Root digging and topping machine ; 23211 Turnip digger with elevator ; 23327 Topping device for sugar beet diggers.

*Sweden* : 39655 Potato digger ; 43016 Hand root-digger and topper.

*United Kingdom* : 117126 Potato digger and harvester.

*United States* : 1271076-1272604-1272986 Beet harvesters.

**THRESHING AND WINNOWER MACHINES.** — *Denmark* : 23234 Attachment for threshing machine.

*United States* : 1271545 Grain cleaner for threshing machine ; 1272790 Grain separator for threshing machine ; 1273462 Grain separator.

**MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN, FODDER, ETC.** — *Canada* : 183548 Grain loader.

*Denmark* : 23243 Straw-cutter.

*Switzerland* : 78916.

*United States* : 1272419 Hay and sheaf loader ; 1273040 Potato loader ; 1273065 Sheaf loader ; 1273312 Portable loader and elevator.

**FORESTRY.** — *Canada* : 183296 Brush cutter ; 183464 Brush cutter and stump remover.

*Sweden* : 43135 Stabilising device for hand saw while sawing ; 43217 Hand saw spring device for felling trees.

**STEERING AND TRACTION OF AGRICULTURAL MACHINERY.** — *Canada* : 183518 Wind mill ; 183831 Tractor.

*Denmark* : 23171-23179-23283 Wind mills.

*France* : 488228 Windlass for mechanical ploughing.

*United Kingdom* : 116855 Steam tractor ; 117114 Endless belt traction engine ; 117125-117699 Tractors ; 117662 Means for attaching a motor tractor to a binder.

*United States* : 1270826 Motor driven vehicle ; 1270991 Traction wheels ; 1271239 Traction belt-chain ; 1271546 One-side endless-belt tractor ; 1271661 Tractor attachment for farm implements ; 1272287-1272475-1272491-1273631-1273652 Tractors ; 1272592 Tractor attachment ; 1273035 Traction and power attachment for motor-car ; 1273350 Tractor attachment for automobile ; 1273470-1273519 Power transmission attachments for automobiles ; 1273582 Wind mill.

**FEEDING AND HOUSING LIVESTOCK.** — *Denmark* : 23153 Hog self-feeder.

*Sweden* : 43261 Calf feeder.

*United States* : 1272591-1273294 Horse shoes ; 1273305 Branding and dehorning squeezers for cattle.

**POULTRY FARMING.** — *United Kingdom* : 117329 Food for poultry, etc.

*United States* : 1271666 Incubator.

**APICULTURE.** — *United States* : 1273286 Horizontal honey extractor.

**INDUSTRIES DEPENDING ON PLANT PRODUCTS.** — *Brazil* : 10186 New process and device for preparing Madeira wine.

*United Kingdom*: 116994 Machine for stoning fruit; 117479 Vegetable cutting and slicing machine; 117557 Machine for filling bottles, cans, etc.; 117582 Machine for capsuling bottles; 117749 Machine for cutting and slicing lemons.

*United States*: 1271065 Baker's furnace; 1271269 Manufacture of non-alcoholic malt beer; 1271371 Preparation of yeast; 1271868 Pine apple fleshing machine; 1271914 Method of treating raw sugar juices; 1272750 Process for preserving fruits and vegetables; 1273120 Hemp drying rack; 1273293 Vegetable dye and process of making same; 1273395 Tobacco drying system and apparatus; 1273396 Heating and drying apparatus.

INDUSTRIES DEPENDING ON ANIMAL PRODUCTS. — *Canada*: 183568 Fish drier.

*United States*: 1271060 Process and formula for tanning hides; 1273662 Process of tanning.

DAIRYING. — *New-Zealand*: 33925 Milk ejector; 39983 Skim milk tank delivery apparatus.

*Sweden*: 43037 Device for separator delivery tank; 43068 Cream delivery control for centrifugal separator bowl; 43190 Churn and centrifugal separator combined; 43259 Improvement to a milking machine; 43262 Churn; 43277 Device for suction milking machine.

*United Kingdom*: 117307 Milking machine; 117355 Churn; 117557 Machine for filling bottles, cans, etc.; 117713 Apparatus for drying milk.

*United States*: 1271153 Milk pasteurizer; 1271367 Centrifugal separator; 1271544 Vacuum milking machine; 1273375 Method of testing milk.

FARM BUILDINGS AND EQUIPMENT. — *Canada*: 183329 Portable sheep fold and shelter.

*United States*: 1270879 Barn ventilator; 1273456-1273673 Wire stretcher.

## AGRICULTURAL INDUSTRIES.

INDUSTRIES  
DEPENDING  
ON PLANT  
PRODUCTS

1278 — Analysis of Portuguese Colares Wines. — GONÇALVES DE SOUSA, J. V., in the *Revista Agronomica*, Year XIII, Series 2, Nos. 1-4, pp. 90-93 + 2 Tables. Lisbon, 1908.

To distinguish the Colares type of wine (1) the author analysed 127 samples of red wine and 23 samples of white wine from these vineyards. Below are given the averages of several determinations. The first figure for each value is for red wines, the second for white wines:—

(1) Colares (or Collares) wines are fine table wines from the vine-growing district of the basin and banks of the Tago. These remarkable wines are made almost exclusively with "Ramisco" grapes, considered the finest of Portugal. They form the basis of the Colares vineyards, 20 miles from Lisbon, on the sandy shore near Cintra. — B. C. CINCINNATO DA COSTA and D. LUIZ DE CASTRO, "*Le Portugal au point de vue agricole*", pp. 389-394. Lisbon, 1900. (Ed.)

*Alcohol*. — by volume, 11.14%, 11.99%; by weight, 8.84%, 9.49 %.

*Total dry extract* : — 23.41 gm., 18.61 gm. per litre.

*Total acidity* (expressed in sulphuric acid per litre) :— 4.65 gm., 4.37 gm.

*Fixed acidity* (expressed in tartaric acid per litre) : 5.96 gm., 5.78 gm.

*Volatile acidity* (expressed in acetic acid per litre) :— 0.95 gm., 0.93 gm.

*Ash* :— About 10 % of the reduced dry extract :— Red wine, 2.42 gm., white wine 1.88 gm. per litre.

*Phosphoric acid* :— In the ash of red wine, 0.20 gm., in that of white wine, 0.175 gm.

*Reducing sugar* : — 1.54 gm, 0.99 gm. per litre.

*Glycerine* : — 6.20 gm, 6.59 gm. per litre.

*Tannin* :— Red wine, 0.81 gm. per litre ; white wine, 0.002 gm. (it could be estimated in three samples only).

*Bitartrate of potash* (by BERTHELOT and FLEURIEU'S method) :— 1.93 gm. 0.75 gm. per litre.

Two tables show the results obtained for each of the 150 samples of wine analysed, and give the localities from which they came.

**1279 — A Study of the Viscosity of Various Colonial Oils.** — HEIM, F., in the *Bulletin de l'Office Colonial*, Year XI, No. 125, pp. 251-264. Melun, 1918.

The author, Director of the Colonial Production Investigation Service, reports work done by this Service. Certain colonial oils, such as castor oil, are of great value for lubricating purposes. As a rule, however, in the case of all fats, even those which are solid at normal temperature, it is necessary to ascertain whether the viscosity constants may be used to characterise and differentiate the fatty bodies. On the other hand the relation between the chemical properties of fats, their viscosity constants and other physical constants require to be defined. The study of the viscosity of latex, rubber solutions, etc. as well as of oils and fats, is of equal interest. Viscosity tests were made with a viscometer made on the same principles as that used for the study of the viscosity of solutions (1).

**CONCLUSIONS.** — Viscosity varies greatly with the temperature so that when viscosity determinations are being made variations in temperature should be guarded against. Comparative tests must be made at the same temperature. The viscosity of oils and fats varies with different physical properties. If oils are divided into three groups, drying, semi-drying and non-drying, the viscosity increases considerably with the density in each group. This also applies to fats.

The viscosity of an oil does not appear to depend on the solidifying point and, except in the case of very viscous oils, it increases with the point of melting or solidification of the fatty acids. In the case of fats it increases with the melting point of the fat or fatty acids.

The viscosity also varies with the chemical composition of the oil or fat and decreases as the oleic acid, i. e., liquid, content increases. It would be very interesting to mix acids or pure fatty glycerides and deter-

(1) See *Comptes rendus de l'Académie des Sciences*, July 8, 1912. (Ed.)

mine all their physical properties. The results would certainly throw much light on the complex question of the composition of oils and fats. Finally, the viscosity varies with the commercial constant known as the iodine value and, for liquid oils, is higher in proportion as this value is lower, i. e., as there are fewer liquid acids.

It should be noted that if liquid oils or fats obey fairly definite laws, this is not true of very viscous oils which sometimes behave as an oil, sometimes as a fat. More numerous experiments will make it possible to clear up this point and to confirm what is already known. In practice viscosity is not only a quality of a lubricating oil, but is also an important physical property for the industrial characterisation of colonial oils and fats.

**1280 — Oil of *Jessenia polycarpa* Nuts and *Caryodendron orinocense* Seeds, in Colombia.** — BACHARACH, A. L. (Wellcome Chemical Laboratories), in *The Analyst*, Vol. XLIII, No. 509, pp. 289-291 + 2 Tables. London, August, 1918.

In Colombia oil is extracted from the nuts of "sejen" (*Jessenia polycarpa* Karst). This oil is known locally as "aceite de sejen" (literally "oil of palm") and is said to be efficacious in chest and lung complaints. It is also used for cooking purposes. It is a pale yellow oil, with a slight fluorescence and not unpleasant smell. Analyses gave the following values: — Saponification value, 188.5; iodine value, 74.1; Hehner value, 93.8. It is seen that this oil is very similar to olive oil.

The seed of the Euphorbiaceae *Caryodendron orinocense* Karst, known in Colombia as "tacay" are eaten roasted. A chemical analysis gave the following results: — Water, 4.43 %; ash, 2.95 %; crude fibre; 2.40 %; oil (ether soluble), 53.20 %; proteins, 12.90 %. The flavour of the roasted seed is somewhat similar to that of burnt almonds, but rather more bitter.

**1281 — Note on Orange-Pip Oil.** — HEWER, D. G., in *The Analyst*, [Vol. XLII, No. 497, pp. 271-273. London, August, 1917.

In marmalade factories the pips are separated by centrifugalisation. Very few attempts have been made to use them commercially though it would be easy, after drying, to extract the oil from them either by pressure or the use of solvents. By the use of petroleum ether the author extracted from the pips 37.5 % of a golden-yellow, almost odourless oil, at first only slightly bitter, but becoming more so on keeping. The oil saponifies easily and should be suitable for the manufacture of soap.

An analysis of the oil gave the following values: — Saponification value, 193.7; iodine value, 100.3; specific gravity at 15°C., 0.9208.

**1282 — On the Composition of Fruit Juices.** — THOMPSON, F., in the *Delaware Agricultural Experiment Station*, [Bulletin No. 119 (Annual Report, 1917), pp. 18-19. Newark, February 1, 1918.

The author has attempted to estimate the citric, malic and tartaric acids in various fruit juices by means of the rotatory power produced with ammonium acetate or molybdic acid. Good results were obtained with pure solutions of the above-mentioned acids, but they did not agree with those obtained with natural fruit juices, probably because of

the rotatory influence of other constituents of the sugars themselves and because the molybdcic acid was reduced. Good results were given by the Prati method as modified by WILLAMAN for estimating citric acid. Preliminary studies of the hydrogen-ion concentrations of fruit juices at different periods of ripening gave constant results. This fact is considered as showing constant acidity. This invariability is probably necessary to allow the action of enzymes.

**1283 — The Industrial Utilisation of the Colouring Matter of Sweet Sorghum Glumes (1).**

— PRÉDALU, A., in *Comptes rendus des Séances de l'Académie des Sciences*, Vol. CLXVII, No. 9, pp. 345-348. Paris, August 26, 1918.

Towards 1850 the presence in the stem of sweet sorghum of a colouring matter giving a red dye was reported. This dye, known as "Baden red", was not used in practice. While studying sweet sorghum flour the author was struck by the colouring capacity of the acid juices which had been used during the hydrolysis of the starch, and tested this colouring matter on various fibres both mordanted and not. He found that the colouring matter could be extracted from the crushed glumes by treating them in the autoclave, under a pressure of 2 kg. per sq. cm., with distilled water containing 1 % of sulphuric or hydrochloric acid or 2 % of sodium bisulphate.

The colouring matter dyes wool, silk, leather and cotton. The acid juice dyes wool directly and silk by boiling, giving a fine salmon colour. A fine series of shades may be obtained by mordanting and intensifying. The shades thus obtained with wool and silk are bright and full, fast and easy to apply, giving beautiful shades varying from violet to fire red with a madder tint (lilac, claret, pink, amaranth, salmon), from fawn to a rich, pure brown, from pearl grey to dark grey. This colouring matter of the glumes of sweet sorghum, as well as that of several varieties of sorghum with black glumes, could no doubt be used advantageously for industrial purposes.

**1284 — Papaine as a Coagulant for Rubber.** — *India Rubber World*, Vol. LVII, No. 5, p. 311. New York, February, 1918.

Experiments were recently undertaken by ULTÈR to determine the value of papaine as a coagulant for *Hevea* latex. An aqueous solution of this preparation proved twice as powerful as an acetic acid solution of the same concentration. The vulcanisation period of rubber thus prepared is normal, but the rubber dries very slowly.

Papaine is the dried milk sap of the papaw tree, a native of Central America and the West Indies, but now introduced into most tropical countries. Papaine acts as a rennet and is sometimes used as a substitute for pepsin in medicine.

(1) See R. Feb., 1918, No. 172; R. April, 1918, No. 467; R. Oct., 1918, No. 1075. (Ed.)

- 1285 — **The Effect of Heat on the Citric Acid Content of Milk.** — SOMMER, H. H. and HART, E. B. (Laboratory of Agricultural Chemistry of the University of Wisconsin, Madison), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 2, pp. 313-318 + 3 Tables. Baltimore, August, 1918.

OBERMAYER stated that boiling decreases the citric acid content of milk. The authors made experiments on the effect of heat on this constituent of milk to determine whether the decreased citric acid of boiled milk is responsible for scurvy or Barlow's disease (1) in children on a milk diet. Many workers (FUNK, GERSTENBERGER) consider the anti-scorbutic effect of certain fruit juices to be due to their high citric acid content.

Several milk samples were heated to different temperatures by different methods, and it was observed that even prolonged boiling (in the autoclave at 15 lb. pressure for 1 hour) did not affect the citric acid content, nor does heat change the salts of this acid to an insoluble form.

- 1286 — **Method of Counting Bacteria in Raw or Pasteurised Milk.** — ALLEN, P. in *The Journal of Infectious Diseases*, Vol. XXII, No. 3, p. 245, March, 1918, reviewed in *Office international d'hygiène publique*, Vol. X, No. 7, pp. 851-853. Paris, July, 1918.

Up to the present the practical bacteriological control of milk has been almost impossible. It could only be done by the general method of isolation on plates, a tedious method requiring at least 24 hours to give a result, and therefore inapplicable in general control as it would be impossible to enforce such a delay before allowing the sale of suspected milk.

The author described in detail a rapid bacteriological method of control which should render great service. An aqueous suspension of alumina mixed with milk holds the bacteria in a tube. By centrifugalising the mixture an alumina clot is obtained containing all the bacteria free from fat and casein. The residue is spread thinly on a slide and stained. As the alumina particles have little affinity for the  $\frac{1}{4}$  dilution of methylene blue stain used, the bacteria can easily be counted.

- 1287 — **A Method for Detecting Bird's Flesh in Meat Preserves.** — GAUTRELET E., in the *Industrie Française de la Conserve*, Year V, No. 22, pp. 217-220. Paris, June, 1918.

It is well known that the oxygen-absorbing respiratory pigment in animal blood varies in colour with the species and according to the intensity of the bio-chemical exchanges in the organism, i. e. it is a) blue through cupric albuminoid — haemocyanin, found only in the lowest animals, b) red through ferrous albuminoid — haemoglobin, only found in a few lower animals (in the free state in the blood) and in all the higher animals in special corpuscles. As the diameter of these corpuscles exceeds that of the largest muscular capillaries it is necessary for them, in order to circulate in the blood, to become deformed to a more or less considerable extent in conformity with the intensity of the biochemical exchanges in oxidation or heat which they have to assure to the organism. In most mammals the capillary "deformity" of the corpuscles is moderate and they are called *discoïds*.

(1) See R. Sept., 1918, No. 952. (Ed.)

In non-cyclostomous fish, reptiles, birds, camels and pacas this capillary deformity is more marked and the corpuscles are called *elliptoids*. The different animal species which have a respiratory pigment within the corpuscles can be rapidly and clearly divided into two groups by a simple microscopic examination:— those with discoid corpuscles and those with elliptoid corpuscles.

The differentiation may be carried yet further. Haemoglobin is never exactly the same in all animal species and the crystallisations of haemin hydrochlorate derived from it are different and typical for each higher animal species. The peculiar physiological properties of the albuminoids of animal tissues make it possible to obtain all the desired solution by means of anaphylactic injections.

The differential detection of animal flesh in meat preserves is, however, a particular one because the meat has been cooked and many workers have insisted that such detection is impossible under these conditions. Nevertheless the author has done so many times by the following method:— on a slide is placed a drop of physiological serum diluted with caustic soda in proportion to the average alkalinity of the blood serum of animals in general (220 mgm. per 100 parts), a mixture is made in the serum on the surface of the slide and, after about ten minutes a direct microscopic examination (without cover glass) is made with a magnification of about 400 diameters.

By these means it is possible to observe the blood in cooked preserves in the form of an amorphous mass of dissociated haematoidin, but also in the classical form of discoid corpuscles if it is a question of mammals (cooked black pudding), or with the haematoidin mass may be recognised elliptoid corpuscles, as in the case of preserves made with bird's blood (e. g. "sanguette fricassée", made of the blood of chicken or duck fried in butter with onions), or, with the haematoidin mass are seen both discoid and elliptoid corpuscles, as in the case of mixed preserve (e. g. blood of pigs and ducks mixed).

CONCLUSION. — A microscopic examination in an alkaline serum medium makes possible a generic detection of discoid and elliptoid corpuscles in the *cooked bloods*, either when *mixed* or *separated*, of mammals and birds, thus making it possible to distinguish easily the origin of the materials used in meat preserves.

1288 - The Yemen Coffee Trade. — See No. 1242 of this Review.

1289 - The Tea Trade in Indo-China. — See No. 1243 of this Review.

1290 - The Development and Future of the Silk Products of Indo-China. — See No. 1264 of this Review.

AGRICULTURAL  
PRODUCTS;  
PRESERVING,  
PACKING  
TRANSPORT,  
TRADE

## PLANT DISEASES

### GENERAL INFORMATION

LEGISLATIVE  
AND ADMINI-  
STRATIVE  
MEASURES  
FOR THE  
PROTECTION  
OF CROPS

1291 - Measures for the Control of Locusts, in Italy. — *Gazzetta ufficiale del Regno d'Italia*, Year 1918, No. 213, p. 2590. Rome, Sept. 9, 1918.

By the decree No. 1214 of July 14, 1918 of the Lieutenant-Governor of Italy which came into force on September 10 it was ordered that :—

Art. 1. — To art. 5 of the decree of June 26, 1913, No. 888 (1) be added the following paragraph : — “ The Ministry of Agriculture may order the control of locusts. According to art. 4 no indemnity is due and no previous order or notification need be made to landowners or managers ”.

Art. 2. — To art. 7 of the same law the following paragraph be added : — Half of the cost of controlling locusts shall be paid by the State which may advance the whole sum. The other half shall be divided between the Province and the invaded or threatened Communes.

When the State advances that part of the expenses incurred in the control of locusts which falls to the Province and the invaded, or threatened Communes, payment shall be by the methods and guarantees mentioned in the first articles of the present decree.

The Communes may contribute by loans, the value of which is deducted from the contribution to be paid by them. They are authorised to demand the necessary aid from citizens capable of work, paying those workers whose position calls for an indemnity.

When, in spite of its obvious necessity, the Communes refuse the aid, the Prefect, on the proposition of the delegates of the Ministry of Agriculture, may pass an order to deal with it.

Art. 3. — The decree, No. 529 of June 15, 1911, is abrogated from the day on which the present decree comes into force.

### DISEASES NOT DUE TO PARASITES OR OF UNKNOWN ORIGIN.

1292 - Root Rot of Citrus in the Oasis of Tripoli. — LEONE, G., in *L'Agricoltura Coloniale*, Year XII, 1st Half-Year, No. 4, pp. 209-215 + 4 Figs. Florence, 1918.

During his studies on the cultivation of blood oranges (“ *démme* ”) the author ascertained that root rot (“ *marciume radicale* ”) of citrus trees is very common in the oasis of Tripoli, where it has existed for some time.

(1) See R. Aug., 1913, No. 995. (*Ed.*)



It is difficult to distinguish affected trees because the disease is already very advanced before signs of it appear on the leaves. The first symptoms are hampered growth, thin twigs, slight yellowing of the leaves, abundant flowering followed by the fall of the flowers and leaves and the partial, then total loss of all the leaves. When the roots are uncovered a strong smell of putrefaction is noticed. The roots are badly diseased, blackish in colour, and soft and spongy. The bark is easily removed, and underneath there are white layers of mycelium. In most cases the affected tree dies. The disease is contagious.

In the soil of the oasis of Tripoli strata of more or less impermeable rock are found at various depths which the roots may reach. The irrigation water may remain more or less on these strata and, as the natives irrigate citrus trees copiously, water being given in summer every five days in quantities much exceeding the needs of the plants, the author considers root rot to be caused chiefly by excess of water. The trees may be rendered subject to the disease by the excessive use of manure containing faecal matter, the rapid fermentation of which may affect the cortical tissues of the roots. This would occur especially where citrus trees are grown in conjunction with vegetables. Whatever the original cause of the root rot may be, abundant irrigation favours its development. Its rapid spread is facilitated by the system of propagation used which usually consists in layering and, more rarely, in the use of cuttings.

The most important preventative measures are : —

- 1) When propagating by cuttings, use cuttings and healthy rooted cuttings from trees unaffected by the disease. The best and safest system, however, is to use plants grafted on bitter orange trees.
- 2) If well-made manure is not available it is best to use mineral fertiliser.
- 3) The roots should not come in contact with the manure.
- 4) Irrigation should not be excessive but reduced to the absolute minimum required.
- 5) Herbaceous plants needing much moisture and organic manure, such as vegetables, should not be grown in conjunction with citrus trees.
- 6) Trees should not be replanted where there are any dead roots.
- 7) Trees should not be planted too deep.
- 8) The plantations should be constantly examined because, if the disease is discovered in its early stages, it may be controlled, in some cases at least, by isolation and care of the plants attacked.

1293 — Disease of the Elm and Nettle Tree, Observed in Italy. — PANTANELLI, E., in *Le Stazioni sperimentali agrarie italiane*, Vol. LI, Pt. 3-6, pp. 214-219 + 2 Plates.\* Modena, 1918.

In August, 1915 the author observed an apparently new disease on young elms and nettle trees (*Celtis australis*) grown uninterruptedly for several years in the Royal Nursery of Aquila. Young elms one to two years old were stunted with short, thin twigs with short internodes, and very developed secondary branches which gave the trees a bushy appearance. The

leaves were very small, covered with small, transparent, yellowish spots, irregular and of varying thickness, generally thinner in the pale areas.

The upper part of the nettle tree was chiefly attacked, and was also stunted, the internodes being short, the branches thin and the development of the secondary branches more rapid than in normal plants. The leaves too were smaller than normal ones, deformed, twisted, wrinkled, and covered with spots of a yellowish-green even in reflected light. The leaves were thinner in the pale areas. Neither on the young trunks nor on the roots was there any sign of an insect or plant parasite, or of any histological disease of these organs. The roots were few in number, little branched, but healthy.

When the stunted trees were transplanted in fresh soil the disease disappeared or diminished more easily in the nettle tree than in the elm, but the growth of the diseased plants was slight, and often they did not survive.

The author has observed in Emilia on several occasions a disease similar to that found in the nursery at Aquila, but, instead of attacking young plants, it attacks the last annual buds of adult trees. These buds are so stunted as to look like "witch's brooms". The author believes this disease to be caused by functional disturbances.

## DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

### GENERAL.

- 1294 — **Fungi of the Valley of San Martino or the Valley of Germanasca, Piedmont, Italy** (1). — PEYRONEL, B. in the *Nuovo Giornale Botanico Italiano*, New Series, Vol. XXV, No. 2, pp. 146-192. Rocca San Casciano, 1918.

This second contribution to the study of the mycological flora of the Vaudois Valleys of Piedmont gives a list of 128 species of macromycetes and micromycetes almost all of which were collected in the Ricaldetto district, mostly at altitudes above 3280 feet, during July, August and September, 1914, and August and September, 1916. Seventy-two species are new to the district, and one is new to Italy. The description of most of the species is followed by morphological and biological observations.

- 1295 — **Fungi from India, Malaya and Africa.** — Royal Botanic Gardens, Kew, *Bulletin of Miscellaneous Information*, No. 6, pp. 207-210 + 8 Figs. London, 1918.

Nine species from India, Malaya, Africa, and Australia are described in the present note, apparently as new to science.

The following species are worthy of special mention:—

- 1) *Fomes elegans* Wakefield, on living *Shorea rubusta* ("Sal") at Singbhum; this polyporus is not reported to have caused serious damage;
- 2) *F. pseudo-ferreus* Wakefield; the cause of a serious disease of the

(1) See R., February, 1917, No. 191. (Ed.)

roots of *Hevea brasiliensis* in Malaya; the disease in question was first attributed to the action of *Poria hypolateritia*; unfortunately the material available at present is imperfect and it seems that perfect fructifications are rarely formed; when well developed ones are available, the description given may have to be revised, but as the species cannot be identified as any known form, a name has been given to it in the interval;

3) *Puccinia Coreopsidis* Wakefield, on *Coreopsis*, in Uganda;

4) *Cercospora latimaculatus* Wakefield on leaves of *Bauhinia* at Aburi (Gold Coast).

1296 — On the Life History of the Rose Blotch Fungus (*Actinonema Rosae*), in Great Britain. — ALCOCK, N. L., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 193-197 + 2 Figs + 1 Plate. London, 1918.

Work on the control of *Actinonema Rosae* (1). — which, according to WOLF does not belong to the genus *Marssonina* (2) — has till recently been hampered by lack of knowledge of its life cycle and the origin of the new attack each season. This problem was solved for the United States by WOLF (1912) who found on dead rose leaves an ascigerous stage, for which he formed the genus *Diplocarpon* (3) belonging to the family *Microthyriaceae*. The perithecia ripen in April and the ascospores formed in them infect the young foliage as it unfolds. There did not appear to be an ascigerous stage in Great Britain, where repeated investigations into this subject had always given negative results. When pruning Juliet roses in the spring of 1918 a patch of discoloured tissue, apparently caused by a fungus, was noticed on the young wood of the previous season. A microscopical examination showed these patches to contain abundant mycelium and compact masses of fungus-tissues bearing spores of *Actinonema Rosae* (4).

The season was well advanced before the infection on the young wood of Juliet was first observed. The roses in most of the gardens had already been pruned and it was no longer possible to obtain much more material or to make a complete list of the varieties affected. The fungus is scarce in the Royal Botanic Gardens, Kew, and appears to die soon if introduced into the neighbourhood. A visit to the Gardens of the Royal Horticultural Society at Wisley showed the wood of the following varieties to be attacked: — Madame Ravary, La Tosca, Mrs. David Jardine, Gruss an Teplitz, and Juliet.

It is not sufficient to collect and burn infected leaves, attention should also be given to the wood of the preceding years and, if it be infected, it should be cut. Experiments in America have also shown that dusting eight times a year with a powder composed of 90 parts of finely ground sul-

(1) See R. April 1911, No. 1294. (Ed.)

(2) See R. June, 1913, p. 879; R. Nov., 1914, No. 1073. (Ed.)

(3) See R. Dec., 1915, No. 1350. (Ed.)

(4) From 1914 onwards was observed in France in the tissues of the stem mycelium attributed to *Marssonina Rosae* and it was henceforth considered that this mycelium might be perennial. See R. Nov., 1914, No. 1073. (Ed.)

phur, and 11 parts of arsenate of lead is very effective in controlling blotch. Bordeaux mixture and lime sulphur are also satisfactory, but disfigure the plants. In badly-infected gardens it is advisable to use a fungicide even if the trees have been carefully pruned, because some pustules are almost certain to have passed unnoticed and spores may be carried from neighbouring gardens by the wind. It is most important to begin spraying early to prevent the fungus from entering the leaves because, should this occur, the mycelium continues to grow in the tissues and the blotches follow inevitably. American experiments have shown that, to protect the trees completely, it is necessary to spray at intervals of about a month.

RESISTANT  
PLANTS

1297 — **Specific Resistance of Different Varieties of Spring Wheat to *Fusarium culmorum* in Sweden.** — ÅKERMAN, Å., in *Svenskes Utsädesföreningens Tidskrift*, Year XXVIII, Pt. 2, pp. 82-89. Malmö 1918

In 1917 spring wheat in South and Central Sweden suffered severely from attacks by *Fusarium culmorum*. According to the author this was due to two causes:— 1) the seed from the 1916 harvest was already badly infested by the *Fusarium* which developed in the damp, rainy weather which prevailed during the harvest; 2) the great drought of the spring of 1917 which greatly weakened the plants, thus making them more subject to disease.

Not all the varieties examined behaved in the same way. The most immune varieties were 0850 (of Sol × Svalöfs Kolben), 0841 *b* (new strain of Extra Kolben), 0810 (of Värpär × Brunt Schlanstedter). These were followed by 0805, 0821, 0821 *b* (of Värpär × Svalöfs Kolben), 0841 (Extra Kolben), Marquis, and a native spring wheat from Dalarna.

The most susceptible (judged by the number of diseased seedlings) were:— 0201 (of Emma), 0804 (of Emma × Värpär), Värpär, Svalöfs Kolben, and Halland native spring wheat.

Numerous controlled experiments confirmed these different degrees of specific resistance the causes of which are not yet known. There is no relation between earliness and the intensity of the attack. The early varieties 0880 (ripe on August 31) and the Halland wheat (August 31), suffered as much as the late varieties 0201 (September 4) and 0804 *b* (September 9). The different behaviour of the varieties may depend on the structure of the flower or the presence of substances toxic to *Fusarium*.

1298 — **Disease-Resistant Sugar Canes, in Porto-Rico.** — See No. 1239 of this Review.

1299 — **Direct Bearers Resistant to Diseases and Pests, in France.** — See No. 1250 of this Review.

1300 — **The Influence of Pruning on the Resistance of Grafted Vines to Diseases and Pests.** — See No. 1231 of this Review.

1301 — **Copper Sulphate and Copper Products in Italy.** — See No. 1210 of this Review.

1302 — **Disinfection of Seed against *Pleospora graminea*, Injurious to Barley.** — LUND, J. and KOPPEL RAWN, F., in the *Tidskrift för Plantæavl*, Vol. XXV, Pt. 1, pp. 56-116 + Bibliography of 20 Publications. Copenhagen, 1918.

From 1908 to 1916 numerous investigations have been made in Denmark to determine the best method of disinfecting seed barley against

*Pleospora graminea* ("Stiibeszyge") which does serious damage to barley crops in the north of Europe.

If the necessary precautions are taken the best results are obtained by soaking the seeds in solutions of formaldehyde, copper sulphate and mercuric chloride. If the material is badly affected it is left in 0.2 % of formaldehyde for 6 hours, or 0.5 % of copper sulphate for 4 hours, or 0.1 % of mercuric chloride for 2 hours. If the material is only slightly affected the time of soaking may be reduced by half.

Treatment with hot water may be carried out in three ways :—

a) soaking for five minutes in water heated to 56 or 57°C., the seeds being softened in cold water ;

b) soaking in hot water followed by the drying of the material at high temperatures — 80°C. or more ;

c) simple soaking in hot water followed by drying in the air at normal temperature.

The best results have been obtained with the last method although it is not so satisfactory as mercuric chloride, formaldehyde and copper sulphate. The appended table gives the efficiency of the different remedies by showing the decrease per cent of affected plants and the corresponding increase in the yield in grain and straw.

Treatment	Number of tests	Percentage of infected plants		Decrease in the percentage of plants infected as the result of the treatment	Percentage of increase in the yield of	
		Grains not disinfected	Grains disinfected		seed	culms
Hot water at 56-57°, followed by drying of the seed at high temperature . . . . .	4	15.3	5.3	10.0	8	4
<i>Idem.</i> without drying . . . . .	17	14.7	1.2	13.5	8	6
Hot water at 50-51°, after softening of the seed . . . . .	11	14.9	1.0	13.9	11	6
Soaking in copper sulphate . . . . .	7	18.6	3.2	15.4	13	7
Soaking in formaldehyde . . . . .	8	20.9	3.4	17.5	12	9

If the treatment has no unfavourable influence on the germinating faculty or germinating energy there is for each percentage decrease in the number of plants infected an increase in yield equal to 0.6-0.8 % for seeds and 0.4 % to 0.5 % for stems.

Early sowing in cold soil favours the development of *Pleospora*. If, in this case, later sowing is impossible, disinfection of the seeds becomes more important than ever.

DISEASES  
OF VARIOUS  
CROPS

1304 - *Bagnisiopsis Dioscoreae* n. sp., an Ascomycete Parasite on Yam in South Nigeria. — WAKEFIELD, E. M., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 6, pp. 199-201 + 4 Figs. London, 1918

In January, 1918, Mr. C. O. FARQUHARSON, Mycologist of the Agricultural Department, Southern Provinces, Nigeria, sent stems of a yam (*Dioscorea*) attacked by a fungus to the Royal Botanic Gardens for identification. The plant attacked was *D. praehensilis* Benth. The fungus, which belongs to the family *Dothideaceae* and is described as new to science under the name of *Bagnisiopsis Dioscoreae*, is undoubtedly parasitic and the disease, although localised, is serious.

The material examined was collected at the beginning of November 1917, in the Okigwi district though the fungus had already been found on *D. praehensilis* in 1911 at Oban, South Nigeria. The parasite attacks the lateral shoots which arise in the axils of normal leaves and causes marked hypertrophy. The internodes are shortened and the leaves dwarfed, and the stem appears much swollen where the elongated black stromata break through its tissues. Frequently numerous stromata occur parallel to one another so that the cortex is almost entirely replaced by fungus tissue.

1305 - *Colletotrichum linicolum* n. sp., Injurious to Flax Seedlings, in Ireland. — PETHYBRIDGE, G. H. and LAFFERTY, H. A., in *The Scientific Proceedings of the Royal Dublin Society*, Vol. XV (New Series), No. 30, pp. 359-384 + 2 Plates. Dublin, August, 1918.

Flax growers in the north of Ireland frequently complain of a disease of the seedlings which they call "yellowing". The attention of the authors was first drawn to this trouble in the early part of the summer of 1916, when diseased plants from farms in Antrim were sent to them for examination. Observations made by one of the authors during the following spring in Antrim and neighbouring counties showed the disease to be common and the cause of considerable damage to the young crop in some cases.

The principle symptoms of the disease are the development of spots on the cotyledonary leaves and lesions on the young stems, which, in many cases, cause the death of the seedling by a process resembling "damping off" (*Pythium de Baryanum*).

A species of *Colletotrichum* was found associated with the disease. This fungus was isolated and grown in pure culture. Infection experiments made with it showed it to be the cause of the disease. To some extent the disease resembles "flax canker", attributed in the United States to *Coll. Lini* Bolley (1910). It resembles more closely a disease of flax in Holland, ascribed by SCHOEVEERS (1915) to a species of *Colletotrichum* which, according to information supplied to the authors by BOLLEY, is the same as the fungus observed by him in America.

Under the name of *Coll. linicolum*, the authors describe the fungus, proved by them to be the specific agent of the disease, as a species new to science. It was found that the mycelium of the fungus hibernates within the cells of the epidermis of the seed-coat and that the disease is transmitted by the seeds. Transmission of the disease may be largely prevented, by deep sowing so that, on germination, the seed-coats remain underground

This, however, is not a practicable method of control. The disinfection of infected seed with formalin and hydrogen peroxide greatly reduced the number of diseased plants but did not completely eliminate the disease. Treating slightly moistened infected seed with a mixture of finely powdered copper sulphate crystals and dry sodium carbonate suppressed the disease entirely.

Flax-seed from Russia, Holland, Canada, and the United States has been found to produce diseased seedlings, and the disease is believed to be widespread all over the world.

1306 - *Phoma destructiva*, a Deuteromycete Injurious to Tomatoes, in Tunis. — GUILLOCHON, L., in the *Bulletin de la Société d'Horticulture de Tunisie*, Year XVI, No. 122, pp. 131-133. Tunis, 1918.

In Tunis in a tomato crop in 1917 and in different gardens in the summer of 1918 a bacterial disease was observed which threatens to become serious if it is not controlled. The first fruits are generally sound, those which form after July being attacked. The disease first attacks the ripe fruit spreading subsequently to the green fruit. The fruit affected is first covered with very distinct spots and finally decomposes, the flesh becoming blackish and deliquescent. The disease is attributed to *Phoma destructiva* (1).

The author recommends the picking and immediate burning of all spotted fruit, whether green or ripe. At harvest time care should be taken not to leave spotted fruit on the ground as insects may visit it and propagate infection.

1307 - *Keithia Chamaecyparissi* n. sp., an Ascomycete Parasitic on the White Cedar *Chamaecyparis thyoides*, in New Jersey, U. S. A. — ADAMS, J. F., in *Torreya*, Vol. XVIII, No. 8, pp. 157-160 + 2 Figs. Lancaster, Pa., 1918.

A description is given of the new species, *Keithia Chamaecyparissi*, found on *Chamaecyparis thyoides*, at Lakehurst, New Jersey, in the summer of 1915 and again on June 14, 1916. The infected leaves turn brown and apothecia develop on the upper surface of the leaves as circular or elongated pustules. Infection is usually confined to the lateral leaves. On most of the dead terminal leaves *Lophodermium juniperinum* Fr., which appears more prevalent and perhaps more injurious than *K. Chamaecyparissi*, was found. It is probable that, under more favourable conditions, both these fungi may cause serious damage.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

1308 - The Coccidiidae *Pulvinaria platensis* n. sp., *P. flavescens* n. sp., and *P. minuta* n. sp., and their Natural Enemies, in Argentina. — CARIDE MASSINI, P. and BRÉTHES, J., in *Anales de la Sociedad Rural Argentina*, Year, LIII, Vol. LII, pp. 148-158 + 10 Figs. + 8 Plates. Buenos Aires, 1918.

GENERAL

The following coccidiidae of the Argentine are described:—

1) *Pulvinaria platensis* Bréthes n. sp., living on *Eugenia* sp.;

(1) See R. July, 1915, No. 759. (Ed.)

[1305-1308]

2) *P. flavescens* Bréthes n. sp., living on lemon tree ;

3) *P. minuta* Bréthes n. sp., living on *Schinus dependens*.

These three coccididae have not done serious damage so far because, according to the authors, their spread is prevented by the following natural enemies, which are also described :—

1) *Tetrastichus caridei* Bréthes n. sp. ;

2) *Aphicus flavidulus* Bréthes var. *caridei* Bréthes n. var. ;

3) *A. flavidulus* var. *nigra* Bréthes n. var. ;

4) *Onophilus caridei* Bréthes n. gen. and n. sp. ;

5) *Pseudaphelinus caridei* Bréthes n. gen. and n. sp. ;

The most efficient natural enemy of the three coccididae appears to be *O. Caridei*.

1309 - The Origin of the Pink Bollworm (*Pectinophora gossypiella*), Injurious to Cotton (1). — MARLATT, C. L., in *Science*, New Series, Vol. XLVIII, No. 1239, pp. 309-312. Lancaster, La., September 7, 1918.

The determination of the original habitat of the pink bollworm (*Pectinophora gossypiella* Saunders) is of great interest in relation to the present distribution of this insect and may be of importance later as indicating where parasitic or other natural checks may be found.

A scrutiny of the records gives strong support to the theory that this insect originated in Southern Asia, probably India. This is in opposition to the theory of J. H. DURRANT (1912) who asserts that the microlepidopteron may be of American or Egyptian origin, as well as to that of A. BUSCK (1917) (2), who considers that the original habitat of the insect is Africa.

1310 - The Fennec Fox (*Canis zerda*), Useful for Destroying Injurious Insects. — See No. 1266 of this *Review*.

MEANS  
OF  
CONTROL

1311 - Control of Locusts in Capitanata in 1917. — PAOLI, G., in the *Bollettino dei Ministeri per l'Agricoltura e per l'Industria, il Commercio e il Lavoro*, Year XVI (1917), Vol. II, Ser. B., Pt. 5-6, pp. 1-5 of Reprint + 1 map. Rome, 1918.

This paper is a report of the measures taken against locusts in the province of Foggia in 1917, under the direction of the author, Control Commissioner in the Capitanata. As the information supplied by the inhabitants was both insufficient and unreliable, thus making it impossible to establish the localities in which the locusts had laid their eggs the year before (1916), the plan of collecting the egg-nests had to be given up and preparations made to destroy the locusts as soon as they hatched. The locusts occurred in the communes of Foggia (*Deciostaurus maroccanus*), of Ascoli Satriano (*D. maroccanus*) and Castelnuovo della Daunia (particularly *Calliptamus*, *Edipoda* and *Stenobothrus* ; no *D. maroccanus*). The insects were most numerous in the first of these communes, propagating even in the neighbouring communes of Lucera and Troia. Hatching was

(1) See R., Sept., 1907, No. 879 ; R., Aug., 1908, No. 865. — (2) See R. Sept., 1917, No. 879 (Ed.)



first reported on May 5 and 11 from the communes of Foggia and Ascoli Satriano.

In the commune of Foggia action was taken immediately, sprayings with 5 % cresosol emulsion in water being increased to 6, 7 and 7.50 % as the insects grew older. At the same time women caught the locusts in cloths. When the cresosol supply ran out sprayings were made with 1, 2 or 3 % sodium arsenite according to circumstances. On account of the enormous number of locusts everywhere it was not possible to spray in all the places necessary because water could not always be found at a convenient distance, and the amount for each band of workers had to be carefully calculated; it was also sometimes impossible to form further bands of workers. As an experiment it was, therefore, proposed to spread bran moistened with 3% dry weight sodium arsenite on the infected soil. The result was absolutely astonishing.

On the whole little damage was done in the commune of Foggia by locusts in the pupal stage. Only a few ears of wheat, low and badly developed, were eaten and cut. In some places large numbers of the insects attached themselves to culms, thus bending them and causing part of the crop to lodge, but without doing harm. Oats suffered most, the locusts gnawing the peduncles at the base of the spikes and causing the caryopses to fall. In a vineyard, the vines of one plot were completely stripped of their leaves.

In spite of the numbers killed by these precautions the locusts continued to increase and reached the adult stage. Spraying with arsenite of soda and the use of poisoned bran were continued for some time. On June 23, when the insects took their flight, the work was stopped. Immense winged clouds fell with great voracity on the vines and other plants — the cereals were already harvested and shocked — and some vineyards suffered severely though the area damaged was limited. The damage is caused by the locusts' eating the petiole, and causing the leaves to fall. In this way vines, olive, almond, fig and wild pear trees, etc., were stripped of their leaves.

In the commune of Foggia laying began about 48 days after the first eggs hatched. An observation service was then begun to note exactly where the eggs were laid. In spite of the millions of locusts destroyed by the various methods of control an enormous number laid their eggs everywhere. According to data collected in the commune of Foggia the total area over which eggs were laid was 2224 acres; in one locality (Posta Corona) nearly 2 400 nests were found in 1 sq. yard.

In the Ascoli Satriano district, where there were not very many locusts, control measures were carried out from May 13 to June 9 with cresosol and sodium arsenite sprayings and cloths. The locusts may be said to have been completely destroyed there.

In the commune of Castelnuovo della Daunia spraying with sodium arsenite was carried out from June 27 to July 5 on a small scale only because of the few locusts.

The results of the author's 1917 experiments show that cloths are of use when the locusts are young and few in number or to prevent their en-

tering a kitchen garden or other small crop, but are absolutely inefficient against large attacks. Cresosol is much more satisfactory if used by capable workmen, otherwise the locusts escape before the mixture reaches them. Cresosol, like all other insecticides with a basis of tar oil, petroleum, etc., spoils the rubber tubing and internal rubber pieces of the pumps. During the experiments no waxed tubes were available and even the leather of pumps with leather pistons was acted on by the tar. Sodium arsenite is more easy to use when attempts are not made to reach the insects directly but to soak with poison the grass on which they feed. The pumps are not destroyed more than normally and the work is easier and does not require special skill. Continual use of arsenite, however, causes burns and inflammations not easy to avoid. Both with cresosol emulsion and sodium arsenite solution abundant water and labour are required, which are not always available locally.

The use of bran or a similar poisoned substance removes many difficulties and gives excellent results. This is the method which should be most generally adopted after as many egg-nests as possible have been destroyed either by collecting them or by superficial turning of the soil so as to destroy as many eggs as possible before they hatch.

The reasons in favour of poisoned bran are :—

1) it may be prepared in one centre, in the present case, Foggia ; it would be useful to investigate the possibility of preparing it mechanically instead of by hand, as was done in 1917, by using a kneading machine, olive mill, or similar apparatus, taking of course, all due precautions ; this would save part of the labour ;

2) no special skill is required to apply it, it is done by hand, but could be done by machine, with a sieve or a manure spreader ; further labour would thus be saved ; the farmers themselves could take the poisoned bran direct from the store and spread it over their land or round threatened crops, thus decreasing the expenses ;

3) mechanical preparation would eliminate the troubles produced on the workmen's bodies by the prolonged use of sodium arsenite.

INSECTS, ETC.  
INJURIOUS  
TO VARIOUS  
CROPS

1312 — Influence of the Date of Earing on Damage Done to Spring Wheat by the Dip-  
teron *Contarinia tritici*, in Sweden. — ÅKERMAN, Å., in *Sveriges Utsädesfor-  
nings Tidskrift*, Year XXVIII, Pt. 2, pp. 90-93. Malmö, 1918.

During the summer of 1917 larvae of *Contarinia tritici* (" Vetemyggan ") caused considerable damage to spring wheat in Sweden by the destruction of a large number of the flowers. An examination of abundant material showed different varieties of wheats to behave differently.

VARIETIES SUFFERING MOST : — 0821 (of Varpal × Svalöfs Kolben), Svalöfs Kolben, Marquis, 0880 (of Svalöfs Kolben × Dala), Dala, and Halland wheat. In all these varieties the date of the beginning of earing coincides with the moment when most of the female insects are about to lay.

VARIETIES SUFFERING LEAST : — 0804 and 0805 (of 0201 × Värpär), 0810 (of Brunt Schlanstedter × Värpär), and 0850 (of Sol. × Svalöfs Kolben).

All these varieties ear later than the preceding ones, when there are far fewer female insects.

To estimate the extent of the damage several ears of different varieties chosen haphazard here and there were examined. Of a total of 61 145 flowers 3360 (5 %) were destroyed. Considering the average yield to be 15.93 cwt. per acre, the loss due to *C. tritici* is approximately 90 lb. per acre.

**1313 - *Cicadula sexnotata*, a Hemipteron Injurious to Wheat, Oats and Barley, in Sweden.** — ELLINGER, T., in *Vort Landbrug*, Year XXXVII, No. 40, pp. 453-454. Copenhagen, 1908.

During the summer of 1918 *Cicadula sexnotata* ("Dvaergcikade") caused serious damage to wheat in the province of Östergötland and spread in Southern Sweden as far as Scania where, however, its attacks were not serious.

The females lay their eggs on the seedling plants and so alter their growth that they sometimes completely prevent seed-formation. The parasite can pass from winter wheat to spring-sown oats and barley, causing similar injury. The damage caused is related to the variety of wheat or other cereal, to the dates of sowing and emergence of the young plants.

The local wheat and the selected variety "Pudel" are highly resistant. The variety "Thule", obtained by NILSSON-EHLE by crossing the local wheat and Pudel, is also distinguished by its resistance.

Early sowing at the beginning of September causes the phase when the young plants emerge to coincide with the moment when the female insects are most numerous. This coincidence is avoided when sowing, owing to rain or other reasons, is retarded and the intensity of the attack is then much diminished.

**1314 - Mite Disease of Potato, in Hawaii.** — CARPENTER, C. W., in *Phytopathology*, Vol. VIII, No. 6, pp. 286-287 + 1 Plate. Baltimore, Md., June, 1918.

A new potato disease was observed for the first time in May, 1917, near Honolulu and Castner, Island of Oahu. It was subsequently found to be present and destructive in all the potato-growing districts of the Islands and is now considered of great importance. When there is a minimum rainfall, whether the plants be irrigated or not, they frequently dry up and die from the growing tip downwards. The small young leaves, both terminal and axillary, become bronzed on the lower surface, twist and curl upon the longer axis. Both the leaves and shoots become abnormally hirsute, dry up, and die. Often the plants grow well until about the time of flowering before being attacked. The yield of the diseased plants is naturally negligible.

Young parts of diseased plants examined with a hand lens were found to be covered with myriads of tiny mites, as yet undetermined, but probably belonging to the family *Tetranychidae*. It is to this insect that the disease must be attributed.

Tomato plants growing under the same climatic conditions were also attacked by a mite which appears similar to that attacking potatoes. It

has not yet been determined whether this disease is as serious in the tomato as in the potato.

When potato crops are attacked by the mite only, experiments have shown good results to be obtained by spraying with lime sulphur, or dusting with dry sulphur. It is advisable to plant lowland crops in autumn or winter so that they may ripen before the dry season begins.

**1315 - *Gelechia ocellata*, a Microlepidopteron Injurious to the Beet, New for Italy.** — DEL GUERCIO, G., in *L'Agricoltura Coloniale*, Year XII, 1st. Half-Year, No. 4, pp. 216-230 + 5 Figs. Florence, 1908.

Description of the life history of *Gelechia ocellata* Bois., followed by preliminary notes on its biology.

This microlepidopteron was recorded for the first time in Italy by the author during the summer of 1917 in the lower Valdarno, near Florence, and was noted to be a pest of the beet. In July, the freshly-hatched larvae begin to feed on the most tender leaves of the beet. It soon reaches the root by tunneling and finally leaves the plant and completes its life cycle.

Owing to the attack of the insect, the beet foliage withers while the development of the root is more or less stopped.

The larvae of the pest sometimes contain those of an endophagous dipteran, probably belonging to the genus *Masicera*. Various means of control have been tried and arsenical solutions seem to promise good results in the control of the larvae of *Gelechia*. At the same time they help to control a fungus (*Cercospora beticola*) and some coleoptera (*Cassida*) which, in Tuscany and other regions, seriously damage the beet.

## INJURIOUS VERTEBRATES.

**1316 - The Preparation of Active Virus Against Field Mice and Method of Applying it in Fields Infested by these Rodents.** — MORI, N., in the *Annali della Stazione sperimentale per le malattie del bestiame*, Vol. IV (1917), [abstract], pp. 1-22. Naples, 1918.

Of the various methods of controlling field mice that which, since LÖFFLER's experiments in Greece (1893) and DANYSZ's in France (1903), has proved most efficient is the application of pathogenic bacteria in the fields with the aim of causing epizootics among the rodents.

LÖFFLER used *Bacillus typhi murium*, isolated from an infectious disease which broke out among the white rats of his laboratory. DANYSZ used a bacterium isolated during a natural epizooty among field mice and known to be also pathogenic to rats. Other workers subsequently studied bacteria related to those isolated by LÖFFLER and DANYSZ. They may all be considered as belonging to the *B. enteriditis* Gärtner group, according to the classification of LEHMANN and NEUMANN. The most important of them — used in infested fields as well as to destroy rats as a preventative measure against bubonic plague — are:—

*B. typhi spermophilorum*, isolated by MERESHKOWSKY during an epizooty among *Spermophilus musicus* ;

LASER's bacillus, from *Mus agrarius* Pallas ;

ISSATSCHENKO's bacillus, isolated during an epizooty among white rats ;

TRAUTMANN's bacillus, causing a fatal infectious disease among grey rats ;

NEUMANN's bacillus, known to be very pathogenic to rats ; isolated from the urine of a child suffering from cystitis ;

*B. septicaemiae murium* Grimm, pathogenic to rats.

Other workers have isolated other bacteria of this group which have been put on the market under more or less appropriate names. In 1916 SPLENDORE isolated from field mice in Apulia a bacterium which he stated to be the cause of a fatal epizooty (1).

The same year the author also observed a natural infection of field mice caused by *Bacterium murisepticum* (Flügge) Mig. (2).

At Foggia the author made laboratory experiments on field mice (*Pitymys savii* and *Apodemus sylvaticus dichrurus*) with a view to using them ventually in infested fields, with two bacteria of the *B. enteritidis* group — *B. caticida* Mori, the agent of an epizooty of cats studied in 1903, and *B. enteritidis bubalorum* Mori, isolated in 1903 from buffaloes. The results obtained were not very different from those obtained with other bacteria of the same group.

The author further studied the results obtained with haemorrhagic septicaemia bacteria and obtained very good laboratory results with *B. bubalisepticus*, *B. bovissepticus*, *B. suissepticus* and *B. avissepticus*. Good field results were also obtained with *B. suissepticus*.

There is much difference in opinion as to the efficacy of virus in controlling field mice and preventing the spreading of plague by rats. Failure must not always be ascribed solely to the kind of virus used, to the more or less rational method of preparing it, the preservation of its virulence or the method of applying it in the fields. In preparing active virus against rodents choice must be made of the bacterium best suited to the purpose unless a microorganism causing a natural epizooty among the rodents to be controlled and possessing the necessary virulence has recently been isolated. The bacterium isolated must be made virulent to the species against which it is to be used by keeping the experimental animals under conditions as natural as possible, as captivity, by weakening them, may influence the results. When a good virus has been obtained it should be kept so that its virulence will neither disappear nor decrease. It must be applied to the fields rationally. To do this it is necessary to know, not only the biology of the infesting bacterium, but also that of the field mice which has hitherto been too neglected. The virus must be applied to the fields at a suitable period and hour in order to give the best results.

The author then studies the choice of bacterium, the keeping of mice

(1) See R. Sept., 1916, No. 1056; R., April, 1917, No. 396. (Ed.)

(2) See R., Oct., 1918, No. 1187. (Ed.)

in the laboratory for the preparation of the virus, the preparation of the virus, the preservation of the virulence of the bacterium in the laboratory, the choice of media in which to distribute virus to those requiring it, and the method of applying the virus in mice-infested fields.

1317 — Susceptibility of Field Mice in Apulia to Certain Microorganisms Used to Control these Rodents in the Fields. — MORI, N., in the *Annali della Stazione sperimentale per le malattie infettive del bestiame*, Vol. IV (1917), pp. 3-51 of reprint. Naples, 1918.

The experiments made by the author in Apulia in 1910 showed that field mice (*Pitymys savii* and *Apodemus sylvaticus dichrurus*) are susceptible to all the bacteria tested, i. e., those of the *Bacillus enteritidis* group, according to the classification of LEHMANN and NEUMANN, *B. typhi murium* (Löffler, Benn stock), *B. typhi murium* (Danysz stock), *B. typhi spermophilorum* (Merezhkowsky stock), *B. caticida* (Mori), *B. enteritidis bubulorum* (Mori) and, of the hemorrhagic septicemia group, *B. bubalisepticus* (Oreste and Armanni), *B. bovissepticus* (Galtier, Lignières), *B. suissepticus* (Löffler), *B. avisepticus* (Perroncito, Pasteur). These bacteria cause the death of the rodents if administered endothoracically, endoperitoneally or subcutaneously.

Even if these bacteria are previously activated by subcutaneous, endothoracic or endoperitoneal passage they do not cause the death of the rodents if the cultures are administered by the digestive tract. If, however, the gastric juice be first neutralised, the same cultures may prove fatal to 100 % of the animals to which they are administered either directly or in their food. After a first passage through the digestive tract, the gastric juice having been previously neutralised, the bacteria re-isolated from the heart and grown in broth are fatal to 100 % of the rodents whether administered by the same method or without any previous treatment. Successive passages through the digestive tract may so weaken the bacteria as to render them inactive.

Experiments with *B. typhi murium* showed that six passages through the peritoneum of *Pitymys savii* sufficed to make the bacteria inoculated through the peritoneum lose their virulence, whereas seven passages through *Apodemus sylvaticus* greatly activated it. Alternate peritoneal inoculations of the two animals gave, after four passages, a virus very active to both, killing 100 % of caged rodents when administered through the digestive tract. The ingestion of infected carrion caused death more rapidly than ingestion of virulent cultures. Field mice may infect other rodents if kept together with them.

All the bacteria examined, no matter by which method they are introduced into the mice, may be re-isolated pure from the heart if the *post mortem* is made soon after death. A period of 4 to 10 days elapses between the administration by ingestion of bacteria of the *B. enteritidis* group accustomed to infect by this method, and death. The virus from the Danysz stock has the most rapid effect (4 to 5 days). In the case of bacteria of the hemorrhagic septicemia group tested the period between infection and death varied from about 15 to 36 hours.

1318 - The Biological Control of Field Mice (1). — SPLENDORE, A., in *Bollettino del Ministero per l'Agricoltura*, Series B, pp. 1-10 of reprint. Rome, 1918.

By order of the Ministry of Agriculture the author has made since 1916 a study of diseases of field mice and, incidentally, of related forms, with the aim of using natural diseases of these rodents in controlling them. He found that these animals are naturally subject to various diseases. Amongst these must be mentioned first of all those caused by certain bacteria new to science:—

1) *Bacterium pitymysi*, found in *Pitymys savii* from the Contessa district, near Cerignola, province of Foggia.

2) *Bact. pitymysi II*, in individuals of the same rodent from different localities in Apulia;

3) *Bact. pitymysi III*, in *P. savii* from Torremaggiore, Foggia.

4) *Bact. pitymysi IV*, in individuals of the same rodent from the same locality.

5) *Bact. muris*, in two specimens of *Mus sylvaticus* from the Cerignola district.

6) *Bact. microti*, isolated from *Microtus arvalis* sent from different districts of the Carso.

7) A bacterium which appears to belong to the family *Bacillus typhi murium* Löffler, found in white rats bought at Rome.

Amongst the diseases of non-bacterial origin found in *P. savii* from the Capitanata are:—

1) An ERUPTION behind the ears causing the skin to peel easily, believed by the author to be the disease commonly known as "rusa"; no specific bacterial agent was found.

2) ECTOPARASITES:— fleas probably belonging to the genera *Ceratophyllus*, *Typhlopsylla*, and *Hystrichopsylla*; lice, which may be placed in the genus *Haemotopinus*, are continually found in large numbers on field mice; a mite of the family *Gamasidae*, rare on adult field mice.

3) WORMS, including certain cestodes of the genus *Hymenolepis*, frequently found in the small intestines of the rodents. Other cestodes have been found in the larval state in the sub-cutaneous tissue, the pleural cavity, the peritoneal cavity and the parenchyma of the liver, in *P. savii*. With the exception of a single specimen of acanthocephalus (*Gigantorhynchus moniliformis*?) in the small intestine of one *P. savii*, only a very small nematohelminth (*Oxyuris*?) was found in the caecum of field mice, and this only in a very few cases.

4) PROTOZOA: a *Hexamitus* near the duodenum; a *Megastoma* throughout the small intestine; a *Trichomonas* in the large intestine; a haemogregarine is sometimes found, the schizogony of which occurs mostly in the lungs, which the author believes represents a species new to science, called by him *Hepatozoon pitymysi*; in three cases was found a sarcosporidium

(1) See R. Sept., 1916, No. 1050; R. April, 1917, No. 396; R. Oct., 1918, No. 1187. (Ed.)

believed by the author to be a species new to science called temporarily *Sarcocystis pitymysi*.

5) FUNGI. In a group of *P. savii* from the province of Salerno the author observed a disease, usually in the respiratory organs, which was undoubtedly caused by parasitic fungi. The cultural experiments made so far have shown the presence of an *Aspergillus* frequently accompanied by a *Penicillium*.

Of all the the diseases mentioned those caused by bacteria are the most likely to produce spontaneous epidemics in field mice. These spontaneous diseases are not rare, and if it be considered that they are fatal and sometimes epizootic — they are contagious and may be transmitted by fleas — the disappearance of field mice so often observed when they occur in large numbers, may be attributed to them as the conditions for spreading contagious diseases are then most favourable.

The best method of spreading these diseases is to send out field mice infected with the virus by sub-cutaneous inoculation. This system is similar to that occurring in nature and is usually certain to succeed. Virus from naturally infected mice is preferable to that obtained artificially by laboratory cultures because, as a rule, the material from natural infection is more virulent than that obtained experimentally.

It is not rare to find in fields, mice which have died naturally. Apart from a microscopic examination, it is easy to determine whether death is due to one of the above-mentioned bacterial infections for, should this be so, the spleen is large and brown. To obtain infected material for use it is sufficient to collect, with the necessary care, the spleen or liver of dead mice and use them while they are still in a good state of preservation. To prepare the inoculations the material is separated with sterilised pincers in salt water (0.80%) which has been previously boiled and cooled. Two drops of the emulsion thus obtained are inoculated into each mouse, which is then let loose in the field to carry the infection. This method is perfectly harmless to man and all useful animals and may be carried out by any careful person, even the farmers themselves, though it is best that it should be controlled and directed by a bacteriologist. In the absence of naturally infected material animals infected in the laboratory might be used.

The disease could be spread by introducing infected mice into a freshly-dug hole in the field. It is not necessary to do this in all the newly-dug holes of the district as infection within a limited area is sufficient. As the infection increases these areas become centres from which the disease spreads over the whole district infected. A few days after the infected mice have been let loose careful observations are made to see if there are still many rodents. If so a second lot of mice are affected with fresh virus to make success more probable.

Infected field mice give better results than infected material. Inoculated mice set free in newly-dug holes will certainly come in contact with other mice and infect them, whereas it is never certain that material placed on the ground will be found and eaten by the mice, especially if plants and other food are plentiful at the time. This system is also economical, requiring



neither a large outfit nor a large staff. If the virus is obtained it is only necessary to catch the mice, and this may easily be done by means of traps.

It may be assumed that during winter conditions are not very favourable to propagation. Fleas are rare on the mice which themselves are scattered, living in families, more or less far from each other, and rarely leaving their holes, living on stocks collected in summer. In this case it is best to introduce the disease directly into each family, either by introducing an inoculated field mouse or by placing a few grains of oats soaked in bacterial cultures into each hole.

[1318]

RUGGERI ALFREDO, *gerente responsabile*.



INTERNATIONAL INSTITUTE OF AGRICULTURE  
BUREAU OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

INTERNATIONAL REVIEW OF THE SCIENCE  
AND PRACTICE OF AGRICULTURE

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OF AGRICULTURAL INTELLIGENCE AND PLANT DISEASES

ABSTRACTS

AGRICULTURAL INTELLIGENCE

GENERAL INFORMATION.

1319 — *An Agricultural Journey through the Belgian Congo.* — LEPLAE, E., *Ministère des Colonies de Belgique, Direction de l'Agriculture*, 44 pp. + 32 Photographs. London, 1918.

DEVELOPMENT  
OF  
AGRICULTURE  
IN DIFFERENT  
COUNTRIES

Since being taken again by Belgium in 1908, the Belgian Congo has developed to an astonishing extent. Not even the war could stop its economic progress. Twenty years ago the Colony was considered an unhealthy country with limited resources which Belgium could only administer and civilise at great expense, without any hope of a good economic future. Since Belgians have learnt to appreciate better its climate, agricultural and mineral wealth, the inherent qualities of the natives and the value of its immense network of rivers, this colony has been looked upon as a rich, healthy country, essential to the reconstruction of the industrial and commercial property of Belgium.

Considerable progress in agriculture has been made of recent years. Native agriculture is being rapidly developed. Important results have just been obtained in the growing of rice, oil palms and cotton. The natives are good farmers and the State sees that they reap the profit from their work. Agriculture in plantations is less advanced. There are, it is true, some large plantations belonging to societies, missions, or the State, rarely to private owners, but they increase in number very slowly and, up till now, Belgians do not appear to have given them the attention they deserve. Nevertheless, the private and State plantations have shown that tropical crops will enable active and persevering planters to make themselves an independent position in a few years.

The little interest taken by Belgians in colonial agriculture seems chiefly due to the fact that this agriculture is little known in Belgium, perhaps also in part to the bad reputation of the Congo climate and the failure of certain agricultural undertakings of the State and plantation societies. The first difficulty is about to be solved by a decision of M. RENKIN, Minister for the Colonies, which annually allows several Belgians who may wish to settle as planters in the colony, to acquire the necessary practical knowledge at very little cost. They may be admitted as students into the plantations and breeding-stations of the Congo State and, during one year, study all the cultural and administrative work. Their number is of necessity limited and fixed in advance (only 20 in 1918). They are engaged by contract as overseers. The State pays almost all their travelling expenses, gives them 10 frs. (8s.) a day, and supplies them with a native servant and the workmen required to clear and plant a kitchen garden. The second difficulty, that of the climate, is already solved. Since Europeans find in the Congo all necessities and have learnt to protect themselves against the common diseases of hot climates, their health does not suffer in any way. The third point, the failure of the State agricultural undertakings and of certain plantation societies, no longer exists in view of the results obtained at the present time. The plantations are some years old and many are bearing (most are composed of trees which bear only when 6 to 8 years old). Experience gained during 10 years at the cost of many failures has made it possible to improve greatly the general position and the agriculturists have obtained a good knowledge of the agricultural conditions of the colony.

The Minister for the Colonies has, since January 1, 1918, placed six plantations of the State under special control. Henceforth they will be exploited commercially, as also will be the private estates. The financial results will be published annually in an appendix to the general Budget of the Colony. The aim of this is to show the public the cost and profit to the Congo of the principal colonial crops (cacao, rubber, coffee, cotton, palm, etc.). The stations which come under this new control are those of Ganda Sundi (Mayumba), Bakusu (Equator), Barmubu and Yangambi-N'Gazi (Aruwini), Lula and Avakubi (Stanleyville), and Nyangwe (Maneima). The last two are not yet ready but soon will be.

*Meteorological service.* — A meteorological service has been organised since 1911 by the service of Agriculture. Three first-class stations have been formed — Banane, Eala and Elisabethville. Second and third class stations have been established in the State plantations and a certain number of mission centres. The Elisabethville Station, fitted up with numerous recording apparatuses and a seismograph for registering earthquakes is unique in Central Africa, both for its equipment and its position. Besides the stations under the control of the Agricultural Service, meteorological observations are made at the wireless telegraph stations. Several other observation posts were organised five years ago to help aviation.

The agricultural necessity of meteorological observations was not recognised in the colony for a long time. The difficulties met with in cotton-growing at the beginning were due above all to insufficient knowledge of

the climate. Astonishing phenomena are sometimes recorded. For example, on June 8, 1916 a temperature of 39° C. at midday was recorded in the table-land in front of the Katentania, Katanga, Station, and — 4° C. at 3 o'clock in the morning in the valley over 1300 ft. below, the difference in temperature being 43° C. Moreover, frost is frequent in the grassy valleys of Katanga in the dry season and makes wheat-growing difficult.

*Experiment stations.* — The State agricultural and breeding stations and plantations are described (1), and a summary given of the experiments made by the Agricultural Department in each. The most important private estates are also mentioned.

*State agricultural stations.*

(The stations marked with an asterisk have been wound up or sold to favour recolonisation).

Stations and plantations	Principal crop or stock	Area planted or grazed, in acres	Stations and plantations	Principal crop or stock	Area planted or grazed, in acres
1) Botanical Garden and Experimental Garden of Bala . . .	—	740	12) Katentania . . .	Cattle	19 769
2) Bakussu . . . . .	Rubber	128	13) Zambé . . . . .	Horses; cattle	5 165
3) Barumbu . . . . .	Cacao	1 000	14) Munama . . . . .	Food plants	124
4) Luala . . . . .	Coffee	247	15) Mobwasa* . . . .	Funtumia	593
5) Ganda Sundi . . . .	Cacao	114		Rubber	
6) Yangambi-N'Gazi . . . . .	Rubber	1 106	16) Dundusana* . . .	"	287
7) Avakubi . . . . .	Funtumia	988	17) Yambata . . . . .	"	291
8) Lemba Congo . . . .	Fruit, fibre	185	18) Likimi* . . . . .	"	314
9) Kitohola* . . . . .	Irrigated rice	805	19) Musa* . . . . .	"	359
	Purebred stock		20) Djombo . . . . .	"	605
10) Nyangwe . . . . .	Cotton; breeding . . . . .	2 471	21) Lonoli . . . . .	"	402
11) Api . . . . .	Elephants	44	22) Mutambale* . . .	Breeding	741
			23) Bokala* . . . . .	Manihot	988
			24) Lonkala . . . . .	Cotton	123
			25) Lukolela . . . . .	Funtumia	247
Total area . . . . .			63 565 acres		
Total area of plantations of rubber, coffee, cacao, palms, etc. . .			10 448 acres		

1320 - *Tsetse Flies and Fly-Belts, in Africa.* — CHRISTY, C. (Major, R. A. M. C.), in the *Annals of Tropical Medicine and Parasitology*, Vol. XI, No. 3, pp. 279-282. Liverpool, January, 31, 1918.\*

A "fly-belt" is not a region where species of *Glossina* belonging to the *morsitans* group can always be found, but a district beyond which the fly is rarely to be met with. It is known that the fly migrates *en masse* from one part of the belt to another within certain limits, a fact that, so far, has not been explained rationally; when flies follow animals or men they leave

(1) The most important have already been described in the original article by M. F. FALLON; see R. Feb., 1917, pp. 177-185. (Ed.)

them as soon as they pass the limits of the belt, outside which there is something inimical to the fly which is unknown to us. The author is convinced that animals play a small or no part in the mystery; he has often found the insect in swarms in regions containing extremely few animals, and he has not found it in regions with plenty of wild animals of all kinds.

The author considers it most dangerous to assume that wild animals are the chief reservoir of sleeping sickness, because a trypanosome sometimes found in them cannot be distinguished microscopically from the trypanosome known to cause the disease in man. The author thinks that the animals to be implicated in the transmission are pigs (wild and especially domesticated) and, in 1914, together with Dr. DUTTON, he noted (*Reports of the Liverpool School of Tropical Medicine, Sleeping Sickness Expedition to the Congo*) that *Glossina palpalis* was frequently seen in the ears of the pigs, often being thus carried considerable distances from the water. The author, wishing to obtain positive evidence for or against the theory, that wild animals were an important reservoir for sleeping sickness, has examined microscopically (as soon after death as possible) the blood of numerous animals. Out of 100 animals, including the giraffe, elephant, buffalo, dinker, pig, colobus monkey, etc., only five were found to have trypanosomes in their blood, and only one, a wart-hog, out of all the number, had a species of trypanosome which might be mistaken for the human trypanosome. Many samples of buffalo blood were examined, but on no occasion were any trypanosomes found in them.

1321 - **Utilisation of the Serum of the Horse for Human Nutrition.**—LINET, L., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 29, pp. 807-810. Paris, October 2, 1918.

It has occurred to M. CESARI ("Vétérinaire-major") that, in war time when no part of an animal fit for food should be neglected, there would be no objection to the substitution of albumin from horse's blood for white of egg in cooking. The blood of the horse contains 8 % of coagulable albumin and white of egg 10 %.

The author describes tests made under the direction of Lieutenant G. LACOUR.

The method followed was to collect the blood under very clean conditions, to extract the fibrin by beating, then leaving to stand to allow the globules to settle. The settling takes place more quickly with blood of the horse than that of the cow, sheep, etc. Settling could be hastened and the serum increased by centrifugalisation.

The author and those present at the tests tasted various dishes in which the serum replaced white of egg (omelettes, rice cake, waffles, etc.) and which were pronounced very good.

The difference in price between horse serum and white of egg is enormous: the blood of a horse fetches about 2*d.*, for which price 20 litres of blood or at least 10 litres of serum are obtained. Supposing that it costs 9 ½*d.* or even 1*s.* 6*d.* with the treatment, even then the 10 litres of serum will replace the whites of 200 eggs; if it is admitted that the white is only one-third the value of the egg, the whites of 200 eggs are worth at least 24*s.*

1322 — On the Appearance of the Antiscorbutic Substance during the Germination of Seeds. — WEILL, E., MOURIQUAND, G. and Mûle, PÉRONNET, in the *Comptes rendus des Séances de la Société de Biologie*, Vol. LXXXI, pp. 607-610. Paris, June 8, 1918.

The authors have found that, contrary to the theories of FURST (1), seeds (oats, barley) during germination (3 days) have no antiscorbutic power whatever as regards the nutrition of the guinea-pig, as such animals fed on germinated seeds showed more intense scorbutic lesions than those fed on dried grains, probably on account of their prolonged survival. This power should appear later, during the development of the plant. Thus, a guinea-pig given a mixture of barley germinated for 3 days and barley germinated for 10 days (grass) showed normal health and growth after 200 days of experiment.

On the contrary, however, these germinated seeds gave the animal a survival that was double, triple or quadruple that given by dried seeds, or reasons most of which remain to be ascertained.

1323 — Organisation of Public Professional Teaching of Agriculture, in France. — I. *Feuille d'Informations du Ministère de l'Agriculture*, Year XXIII, No. 33, pp. 1-3. Paris, August 13, 1918. — II. *Bulletin de la Société des Agriculteurs de France*, pp. 199-200. Paris, August, 1918.

AGRICULTURAL  
EDUCATION

The new French law of August 2, 1918, on the organisation of public professional teaching of agriculture in France, is intended, according to M. VIGER, who presented the law to the Senate, to provide agricultural education no longer for 2000 youths and a few hundred girls, but for 1 million youths and 1 million girls.

1) EDUCATION FOR YOUTHS. — *Agriculture* is taught (art. 1): — 1) at the "Institut national agronomique", which is the normal higher school for agriculture; 2) at the National Schools of Agriculture of Grignon, Montpellier, Rennes; 3) in the schools of agriculture including a) schools of practical agriculture; b) the farm schools; c) the technical schools where some agricultural speciality is taught; 4) in the winter or seasonal schools of agriculture; 5) in the agricultural continuation courses.

*Horticulture* is taught: — 1) at the National Horticultural School at Versailles, which is the higher school for horticulture; 2) in the schools of horticulture as in section c (technical schools).

In order to give a thorough practical training to the pupils leaving the National Agronomic Institute wishing to take up an agricultural career or become professors of agriculture, practical schools will be founded on the estates of the National Schools of Agriculture, at Grignon, Montpellier and Rennes. These schools could also be attended by students from the national schools wishing to specialise and by free auditors (see art. 3 of the law). As regards the *practical schools*, owing to the bad results given by the way of running some of them as actual farms on which the director-farmer, obliged to make the greatest possible profit out of his farm, considers the students as labourers, in many cases, rather than real pupils.

(1) FURST. — *Zeitschrift für Hygiene and Infektionskrankheiten*, 1912, LXXII, p. 122. (Authors' note).

the law provides that save in exceptional circumstances the farm shall be run either on behalf of a commune, a department, or the State (art. 10).

The really new part of this law is that tending to create and spread everywhere in France the winter or seasonal agricultural schools and public continuation agricultural education.

Art 14 — The *winter or seasonal agricultural schools* are fixed or travelling. They are designed to give, during the bad season, professional instruction to the sons of farmers who cannot spend 2 or 3 years in a professional school of agriculture. They are controlled by the Minister for Agriculture.

According to art. 20, *continuation agricultural instruction* can be given in public schools or in premises placed at the disposal of the State by the communes or private persons. In each commune, the course is started either on request of the municipal council, or on request of the departmental commission provided for in art. 23, and on a favourable report from the general Council. The course, according to art. 22. of the law, is paid for by the department.

II). EDUCATION FOR GIRLS. — Art. 26 — Instruction in agriculture and housewifery for girls is given :—

1) at the National Agronomic Institute ; 2) in the National Schools of Agriculture ; 3) in the agricultural housewifery schools, which may be fixed, temporarily fixed or temporarily travelling and which will be known as "*Ecoles agricoles ménagères*", "*Ecoles agricoles ménagères temporaires*", and "*Ecoles agricoles ménagères ambulantes*" ; 4) in the course of continuation instruction in agricultural housewifery.

The conditions under which the new law is to be applied will be fixed by the rules of public administration.

#### AGRICULTURAL INSTITUTIONS

1324 — High Council of Agricultural Stations and Laboratories, in France. — *Journal Officiel de la République Française*, Year L., No. 222, p. 7280. Paris, August 16-17, 1918.

An order of the Minister of Agriculture, dated August 12, 1918, constituted a High Council of Agricultural Stations and Laboratories composed of 25 members, 9 of which are elected by the "*Académie des Sciences*", 6 by the High Council from competent persons of note, and finally 4, representing the Minister of Agriculture, are named by him. The members are appointed for 3 years and one-third will be re-elected each year; they are eligible for reelection. The General Inspector of Agricultural Laboratories will be present at the meetings for purposes of consultation. The Council has to watch over the working of the agricultural Stations and Laboratories, to guide and direct them in the path assigned to them so as to make them as highly useful as is possible. It treats with all questions relating to scientific researches to be undertaken and to be carried on in those establishments.

#### EXPERIMENTAL AND ANALYTICAL WORK

1325 — Recent Investigations at the Imperial Institute, London. (1) — *Bulletin of the Imperial Institute*, Vol. XV, No. 4, pp. 465-503, 544-568. London, October-December, 1917.

UTILISATION OF STALKS OF FLAX CULTIVATED FOR SEED. — As a rule

(1) See R. Oct., 1918, No. 1075. (Ed.)

[1322-1325]



the stalks of flax from which the seed has been removed are burnt. This is the best way of utilising small quantities as the ash can be applied as fertiliser. When, however, as in Argentina, the United States, and Canada, flax is grown on a large scale, other possibilities should be considered. At present there are two such possibilities: — 1) production of tow from the stalks; 2) the manufacture of paper pulp or paper. Both these methods demand expensive equipment and can only be adopted where there is a large quantity of raw material and a local market for the final product, which is not sufficiently valuable to export. In Rhodesia the cultivation of flax as an oil-yielding plant is rapidly increasing, and the British South Africa Company sent to the Imperial Institute a sample of flax stalks for information as to the methods of utilising them. The sample contained 11.1 % of moisture and 3.6 % of ash. The fibres extracted were from 12 to 25 mm. long. Treatment with caustic soda gave 44 % of strong paper which did not bleach easily. Treatment with sulphite gave 45 and 46 % of paper which bleached without difficulty. By crushing between rollers, beating and threshing, about 23 % of tow suitable for paper-making was obtained. When treated with caustic soda the tow yielded 50 % of paper but little superior to that obtained from the whole stalks. The shieve when treated with caustic soda gave 43 % of pulp which did not bleach and could only be utilised if mixed with longer-fibred material or for making very common paper.

PRODUCTION OF SISAL HEMP. — Samples from South Africa, British Honduras, and the Belgian Congo gave on analysis the following results:— Moisture, 8.2, 10.1, 9.5 %; percentages on dry fibre basis. — Ash, 1.6, 0.7, 1.1; loss on  $\alpha$ -hydrolysis, 9.3, 11.3, 14.8; loss on  $\beta$ -hydrolysis, 10.8, 13.6, 15.9; loss on acid purification, 1.3, 2.3, 2.2; loss on washing in water, 1.3, 2.6, 2.0; cellulose, 79.2, 76.7, 74.8. The first two were of good quality, the third less so.

FIBRES FROM THE BELGIAN CONGO (1). — Besides the Sisal hemp (*Agave rigida* var. *sisalana*) mentioned above fibre of the following plants was examined:— Bowstring hemp (*Sansevieria cylindrica* and *S. guineensis*), Mauritius hemp (*Furcraea gigantea*), Manila hemp (*Musa textilis*), ramie (*Manniophyton africanum*, *Boehmeria nivea*), and *Arenga saccharifera*. On analysis the first four gave the following percentages respectively: — \* Moisture, 8.5, 9.2, 8.45, 8.5; on dry fibre basis: — Ash, 0.4, 0.9, 0.75, 0.9; loss on  $\alpha$ -hydrolysis, 9.0, 10.4, 11.35, 11.8; loss on  $\beta$ -hydrolysis, 13.0, 13.7, 15.75, 21.0; loss on acid purification, 1.1, 2.0, 1.15, 2.4; loss on washing in water, 1.1, 0.4, 0.9, 1.8; cellulose, 74.0, 76.5, 77.4, 75.0 (the figures for *Furcraea gigantea* are the averages of two samples). Bowstring hemp is obtained from several species of *Sansevieria*, chiefly from *S. Ehrenbergii* of East Africa, *S. guineensis* of West and East Africa and *S. cylindrica*, found from Zanzibar to Angola. The fibre is used for cordage. *Manniophyton africanum* is an Euphorbiaceae confined to tropical West

(1) For other fibres of the Belgian Congo previously examined see R. Feb., 1917, No 1118. (Ed.)

Africa. The bark is utilised by the natives of the Belgian Congo (where the plant is known as "N'kossa") for the extraction of a strong fibre used for making fishing lines. The samples examined were considered suitable only for making strong, but very coarse ropes. By degumming with dilute alkaline solutions a clean, fine, but weak fibre is obtained. *Arenga saccharifera*, or sago palm, is commonly cultivated in India, chiefly as a source of palm wine and sugar, and has been introduced into most tropical countries. From the base of the petiole is obtained a black fibre known as "ejow" or "eju", much used in the East. Three qualities are prepared: — 1) coarse, for brush making, 2) medium, for rope-making, 3) fine, for stuffing cushions and as tinder. The samples from the Belgian Congo were judged of good quality as material for stuffing, brushes, etc.

PRODUCTION OF OIL-YIELDING SEEDS FROM RHODESIA. — The production of oil seeds promises to become an important industry in Rhodesia. The only oil seeds at present produced on a commercial scale are peanuts and sunflower seeds, but experiments made at the Salisbury Agricultural Experiment Station have shown that other oil seeds, including linseed, sesame, niger seed and *Madia sativa* (locally known as Chile Oil seed), may be grown successfully. The cultivation of peanuts is steadily increasing as a result of the introduction of improved varieties by the Department of Agriculture. The exportation of sunflower seeds promises to become important. Peanuts and castor-seeds are grown by the natives in some parts of the country and the oil extracted for local use. Various oil seeds are being grown at the Government Experimental Gardens at Mazabuka and Chilanga, North Rhodesia. Samples of seed sent from these gardens to the Imperial Institute for examination gave the following yields in oil (on a dry seed basis): — Red Zanzibar Castor bean (*Ricinus sanguineus Zanzibaricus*), 51.1 %; black sunflower, whole seed 27.5 %, kernel 49.1 %; striped Russian sunflower, whole seed 21.5 %, kernel 48.8 %; sesame, 53.1 %; white flowering linseed, 34.7 %, Pskoff linseed 35.9 %.

NEW PALM NUT FROM COLOMBIA. — The sample examined at the Imperial Institute was sent from the Tropical Agricultural Station, San Lorenzo, Colombia. Two varieties of the palm are very common in the Magdalena valley, one with large fruit, found in the lower valley, where it is known as "çoroza", one with smaller fruit, found in the higher valley, where it is known as "cuesco". The sample examined belonged to the first variety and appears to belong to *Scheelea excelsa* Karst. (= *Attalea excelsa* Mart.). The fruit consists of two or three nuts in a hard shell. The kernel, which is difficult to remove, contains 4 % of moisture and yields 65.4 % of fat melting at 29° C. In appearance the fat is similar to that of several kinds of palm (palm kernel and coconut oils), but differs from them in chemical characters (low saponification value, 224.6; high iodine value 35.2 %; relatively small quantity of volatile acids, 2.1 % soluble and 3.0 % insoluble). The oil of these nuts is much valued in the tropical parts of Colombia, where it is used for cooking, burning, soap-making, as a lubricant and as a medicine.

WATTLE BARK AND WOOD. — Before the war the British market obtained much tanning material from the Continent; this market being closed,

attention was turned to the large supplies of wattle bark in South Africa, and the manufacture of wattle bark extract was undertaken in South Africa as well as in the United Kingdom; 6 505 tons of the bark were shipped direct from Natal to Russia in 1916. Wattle barks are derived from various species of *Acacia*, indigenous to Australia and introduced into South and East Africa, where they are grown in plantations. The best known as a tanning material in Europe is the bark of the black wattle (*Acacia decurrens* var. *mollissima*). The production of wattle bark is a very important industry in South Africa, especially in Natal, and it is rapidly growing. In 1916, there were about 160 000 acres under wattle in Natal; the exports of chopped bark from South Africa rose to 50 867 tons with an average price of £ 13 10s per ton. The chief sources of the Australian bark are the golden or broad-leaved wattle (*A. pycnantha*) and the black wattle (*A. decurrens* var. *mollissima*). In the East Africa Protectorate there are about 12 000 acres of wattle.

Commercial wattle bark contains an average of 32 % of tannin. Material remaining after being used for tanning or preparing the extract can be used for the production of paper; the wood can be used either for dry distillation or paper making. In experiments made at the Imperial Institute spent wattle bark (containing 11.5 % of moisture, 41.2 % of cellulose and 8.7 % of ash) yielded, according to the treatment, from 28 to 35 % of dry unbleached paper pulp. Commercial tests in a paper works gave from 28 to 30 % of pulp quite suitable for making brown paper.

Wattle wood yields 61 % of cellulose (expressed on the dry material) and gives from 46 to 50 % of pulp which is lacking in strength owing to the shortness of the fibres. The pulp might be used for making "straw-board" especially if mixed with equal parts of spent wattle bark.

THE PRODUCTION OF TURPENTINE OIL AND ROSIN IN INDIA. — Turpentine-yielding trees are common in the forests of the Himalayas, in the United Provinces, in Assam, Burma and the Punjab. The oil and rosin extracted are used locally, but the quantity produced does not suffice. The chief source of Indian rosin is the Chir pine (*Pinus longifolia* Roxb.) which must be distinguished from the American *P. longifolia* Salisb., now usually known as *P. palustris* Miller. The latter is the longleaf pine of the Southern United States, and is the chief source of American turpentine oil and rosin. Five species of pine are indigenous to India: — *P. longifolia* Roxb (Chir pine), occurring in the Outer Himalaya and Swalik Range; *P. excelsa* Wall., (Kail or blue pine), occurring in the temperate Himalayas; *P. Khasya* Royle (dingsa or khasia pine), occurring in the Khasi hills, in Assam and Burma; *P. Merkusii* Jungh. and de Vriese (tinyu pine), of Burma; *P. Gerardiana* Wall. (Neosia or Himalayan edible pine) on the inner dry and arid West Himalayas. *P. longifolia* is the most important species in India for the commercial production of turpentine and rosin, smaller amounts being derived from *P. excelsa* and *P. Khasya*. *P. longifolia* is gregarious over about 2 068 530 acres, but it is tapped only in the Kurmann Division of the United Provinces and in Rawalpindi, Punjab. *P. excelsa* occupies about 65 000 acres in the United Provinces and the Punjab. *P. Kha-*

*syra* occupies an area of 33 sq. miles in Assam. Both in the United Provinces and in the Punjab, the tapping of the trees and the distillation of the oleoresin are conducted by the respective Forest Departments, whilst the sale of the turpentine and rosin is controlled by the manager of the distillery at Bhowali, in the United Provinces. In 1915-1916, in the United Provinces, 981 906 trees were tapped on 49 135 acres, giving 2 089 tons of crude oleoresin; the Bhowali distillery produced 1285 tons of rosin and 80 390 gallons of turpentine. The Indian turpentine oil from *P. longifolia* yields practically no distillate below 165°C., and for this is quite different from American turpentine oil, which should yield not less than 70 % by volume between 155° and 160° C.; it most nearly resembles Russian turpentine oil. *P. longifolia* oil distilled above 175°C contains 25-33 % of *l*-terpene boiling at 173°; the large proportion of this constituent renders the Indian oil inferior to the best French and American turpentine oils, which consist almost wholly of pinene boiling at 156°C. Indian turpentine oil can be used, however, like the other varieties.

**COPAL FROM COLUMBIA.** — The Imperial Institute has examined a sample of copal sent by the Director of the tropical Agriculture Station, San Lorenzo, Colombia. The copal is known locally is "ambara" or "algarovillo" and before the war, was exported to some extent to Germany. The sample submitted was of good quality and has the following characteristics: — moisture, 0.52 %; ash, 0.09 %; melting point, 123°C.; acid value, 100.8; saponification value, 103.6; loss on melting, 18.0 %.

**TOBACCOES FROM NYASALAND AND UGANDA.** — In 1916-17 there were 7 484 acres under tobacco, in Nyasaland, giving an export of 4 304 124 lb., besides quantities stored. Three sets of samples, grown and prepared on the Government Farm at Namiwawa, Nyasaland, and illustrating *a*) the results of topping experiments, *b*) of manuring tests, and *c*) grades of tobacco forwarded to London for sale, were examined by the Imperial Institute.

*a*) The 9 samples of "Gold Leaf" tobacco, topped at different heights so as to mature from 7 to 15 leaves per plant, were very similar; it seems that, on the whole, higher topping, viz., to produce 14 to 15 leaves, is not disadvantageous.

*b*) The 6 samples of "Conqueror" tobacco were manured as follows: — 1) lime; 2) cattle manure; 3) cotton seed; 4) control; 5) lime and cattle manure; 6) lime and cotton seed. The effect of the different methods of manuring was not very marked; certain treatments, especially those with lime + an organic manure, produce a slightly stronger flavour due to the increase in the percentages of lime and nicotine. The burning properties were not noticeably altered by the manuring in any case.

*c*) The tobacco growers of Nyasaland grade their tobacco into two groups: — *a*) mahogany and dark leaves of heavy or good body, suitable for pipe and plug tobacco, and *b*) brighter and thinner leaves suitable for cigarette tobacco. Each group is further divided into commercial grades.

Tobacco is grown on a comparatively small scale in Uganda, mainly by the native for local consumption.

Samples of Virginia tobacco grown and cured on the Nambeya Estate,

Bulemezi, Mengo District, near Kampala, had a good chemical composition (moisture 14.0 % ; nicotine 1.9 % ; nitrogen 2.7 % ; ash 18.7 %) with a low percentage of nitrogen and a large proportion of potash (the ash contained: — lime 26.0 % ; magnesia 9.4 % ; potash 34.6 % ; soda 3.1 % ; sulphuric anhydride 3.0 % ; chlorine 1.9 %).

## CROPS AND CULTIVATION.

1326 — The Question of Hail-rods and Storms in the Gironde, France, in 1918. — ANGOT, A., in the *Comptes rendus de l'Académie d'Agriculture de France*, Vol. IV, No. 30, pp. 838-840. Paris, October 9, 1918.

AGRICULTURAL  
METEOROLOGY

M. ANGOT has presented to the Academy a study, by M. COURTY, astronomer to the Bordeaux Observatory, on the storms observed in 1917 in the Gironde and part of Dordogne, a region furnished with a large number of hail-rods ("niagaras électriques").

In his report, M. COURTY gives a table showing the localities where hail-rods have been installed and the number of times that hail fell in these localities during the 6 years 1911-1917. In two localities the observations ended in 1916 at the same time as the Municipal Council requested the prefect to order the removal of the hail-rod as they blamed it for the frequency with which hail had fallen since the hail-rod had been set up. On the contrary, in two other localities no hail was observed during the six years.

M. COURTY simply gives the facts observed, without drawing conclusions, while expressing the wish that these observations should be continued. In fact, the irregular appearance of hail throws doubt on any conclusions that might be drawn from a small number of observations.

M. ANGOT supports M. COURTY's wish, as the results will be all the more searching as the period of observation is longer. The 5 years of observations made by the author of the study tend to confirm M. ANGOT's previous opinion: that hail-rods have no influence whatever on hail.

1327 — Relation between Climate and Cereal Yield in Sweden. — WALLÉN AXEL, in *Ymer*, Year XXXVIII, Pt. 1, pp. 1-23 + 2 Figs. + 2 Tables + Bibliography of 8 Publications. Stockholm, 1918.

The author has calculated for every province of Sweden the coefficient of correlation,  $r$  (1), between the monthly temperature, monthly rainfall and yield in grain of barley, oats, wheat and rye. Numerous graphs illustrate the figures clearly and maps show the lines of distribution of the values of  $r$  by province, thus making it possible to form a clear idea of the relation between the meteorological factors and agriculture in the different districts of Sweden.

WINTER CEREALS (WHEAT AND RYE). — In the coast districts of southern Sweden (Malmöhus, Kristianstad, Blekinge, Gottland Island, the southern part of Kalmar, Halland) the maximum values of  $r$  with regard to temperature for wheat are: — November — 0.23; May — 0.21; January

(1) See R. Feb., 1918, note to No. 148, p. 175. (Ed.)

+ 0.28; February + 0.26. The summer values for  $r$  are low, but constantly negative. This is certainly due in part to the hot summer of 1901 which was very detrimental to the crops of the south which generally lacked rain.

The coefficient of correlation for precipitation is always very low, except in May, which has very high positive values: — Kalmar + 0.59; Blekinge + 0.52.

A temperate winter, cool and rainy May, and a moderately warm summer are necessary to obtain a good wheat harvest in the coastal districts of South Sweden. About the same conditions are necessary for rye.

As the north and interior of the country (Göteborg, Älvsborg [the part south of Vänern], Jönköping, Kronoberg, the north of Kalmar) are approached the total temperature decreases gradually and the correlation coefficient for the summer months becomes positive, a hot summer being necessary to ensure ripening. For winter, on the other hand, the observations respecting the preceding zone hold good here as well — February + 0.22, March + 0.24, April + 0.23. The gradual lowering of the temperature is accompanied by an increased rainfall which assures the plants the necessary amount of moisture for each stage of their growth. The result is that the relation between yield and precipitation tends to be nil and the values for  $r$  are always very low.

The same conditions exist for rye, though the value for  $r$  expressing correlation between yield in grain and the temperature of November and December is in this case negative. In the provinces of Östergötland, Älvsborg (to the west of Vänern), Sävleborg, and other provinces of Svealand, the lack of heat is still more marked. As a result, except for August and September, the correlation coefficient between temperature and yield for the vegetative period is always positive: — August — 0.39, September — 0.21, November + 0.21, February + 0.26, March and April + 0.25. The values of  $r$  for rainfall are distinctly positive for August, September, April and May (sowing, appearance above ground, earing), and negative for June and July. For rye, unlike wheat, a temperate winter is disastrous. The value  $r$  is markedly negative in January and remains positive in February, but is almost negligible.

In the northern provinces of Jämtland, Västernorrland and Norrbotten, where only rye is grown, the coefficient of correlation of temperature is always positive, except in September, and the maximum values occur in April, May, and July, when they are + 0.41, + 0.44, and + 0.42 respectively. For precipitation the values are: — October + 0.27, June + 0.23, August — 0.48.

The most striking facts deduced from these data are: —

1) The existence of a negative correlation coefficient between yield in grain and the temperature of August and September in northern and central Sweden and some parts of southern Sweden.

2) A negative  $r$  value for the temperature of November and December, especially in South Sweden.

3) A positive relation between the temperature of the winter months

and yield, the value of which decreases as the north is approached until it is reversed and becomes negative (Norrbotten, etc.).

4) The favourable influence of a cool, wet May in South Sweden.

5) In the northern provinces there is a positive correlation with the temperature of the summer months, i. e. the best crops are obtained after a hot summer. As the south is approached the ratio decreases, with the increase of the total temperature till it is inverted, so that in some coastal districts of the extreme south with a low rainfall the best crops are obtained in cool, wet years.

SPRING CEREALS (BARLEY AND OATS). — The values for the provinces of Malmöhus, Kristianstad, Blekinge, South Kalmar and Halland are:—

Temperature	$\left\{ \begin{array}{l} \text{Barley: May} - 0.23, \text{ June} - 0.12 \\ \text{Oats: May} - 0.24, \text{ June} - 0.10, \text{ August} - 0.35 \end{array} \right.$
Precipitation	$\left\{ \begin{array}{l} \text{Barley: May} + 0.22 \\ \text{Oats: May} + 0.29, \text{ June} + 0.32. \end{array} \right.$

In the other provinces of South Sweden, unlike the preceding case, the temperature values for  $r$  are positive during all the months except June and July. In Central Sweden the temperature values for barley and oats are positive in March, April and August, and negative in May, June, and especially in July ( $r = -0.31$ ). Except in August the value of  $r$  for rainfall is always positive:—

Barley:	May + 0.21; June + 0.23; July + 0.28
Oats:	May + 0.32; June + 0.34; July + 0.35.

The best barley and oat crops, therefore, are obtained in wet years. As the north is approached rainfall becomes more and more abundant so that all relation between rainfall and grain yield tends to disappear while the effect of temperature becomes more and more marked, the correlation coefficient becoming positive for every month without exception, the maximum value — *Barley* + 0.38, *Oats* + 0.40 — occurring in June. It may be concluded that the most important meteorological factor for spring cereals is precipitation in Central and South Sweden (especially the May and June rains), and temperature in North Sweden.

FORECASTING THE YIELD. — The use of the correlation coefficient makes it possible to forecast the yield of a future crop within certain limits which are all the more certain as the value of  $r$  is higher. Thus, for example, in the province of Malmöhus, the author was able to determine the following coefficients of regression (1) for winter cereals:—

1) For each degree of the average temperature of August above the normal, the yield in grain *decreases* by 0.18.

2) For each degree of the average temperature of November and December above the normal, the yield *decreases* by 0.50.

3) For each degree of the average temperature of January and February above the normal, the yield *increases* by 0.14. ●

(1) See *R.* March, 1918, note to No. 279, p. 315. (*Ed.*)

4) For each 10 mm. of rainfall above the normal in October and November, the yield *decreases* by 0.06.

In 1916-17 the average temperature of August exceeded the normal by  $0.2^{\circ}$ , that of November and December exceeded it by  $1.6^{\circ}$ , but that of January and February was  $1.7^{\circ}$  below the normal. The rainfall for October and November was 30 mm. above the average. If the figures given above be applied a total decrease in yield is found which may be expressed by 1.3 (coefficient of regression). The author gives several other such examples, all of which show the practical value of the coefficient of correlation in forecasting the harvest.

1328 - **The Effect of Temperature and other Meteorological Factors on the Growth of Sorghum.** — VINALL, H. N. and REED, H. R., in the *Journal of Agricultural Research*, Vol. XIII, No. 2, pp. 133-147 + 2 Plates. Washington, April 8, 1918.

The varieties of sorghum studied were Sumac, Red Amber, Honey, Blackhull Kafir, Dwarf Milo and Feterita, and the meteorological observations were made at Chillicothe (Texas), Chula Vista and Bard (California), and Puyallup (Washington), stations having widely different climatic conditions. The contrast between the last two is very marked, Bard having a high temperature and a high percentage of sunshine during summer, whereas the maximum temperature at Puyallup does not reach the optimum temperature for sorghum ( $33^{\circ}$  C.). These conditions greatly influence the growth of the plant. The data collected from 1915 to 1916 lead to the following conclusions: —

1) *Sorghum is a plant specially adapted to tropical and semi-tropical climates and cannot thrive in cold regions.* — At Chillicothe and Bard, where the average temperature during the vegetative period is  $25.8^{\circ}$  C. and  $28.2^{\circ}$  C. respectively, sorghum does very well and ripens in 106 and 129 days after sowing, reaching an average height of 68 and 82 inches and a stem diameter of 0.79 and 0.68 inches. At Chula Vista, where the average temperature is much lower ( $18.2^{\circ}$  C.), the grain ripens a month late (average date for the six varieties of sorghum; November 14), and the vegetative period lasts 141 days. At Puyallup, with a temperature of  $15.3^{\circ}$  C., sorghum does not ripen, so that it may be considered outside the sorghum belt. The difference between the total positive temperature (i. e. above  $19^{\circ}$  C.) during the vegetative period —  $1052^{\circ}$  C. at Chula Vista and  $897^{\circ}$  C. at Puyallup — is very small, and not sufficient to explain the different behaviour of the plant in the two localities. Another meteorological factor, the amount of sunshine is concerned in this.

2) *Application of LINSSER'S law to sorghum.* — The total positive temperature is  $1052^{\circ}$  C. at Chula Vista,  $2353^{\circ}$  at Bard,  $1682^{\circ}$  at Chillicothe. According to LINSSER the amount of heat required for the development of a certain stage is not the same in all parts of the area of distribution of a plant but increases with the annual total of positive temperatures. By dividing the total positive temperatures for the vegetative period by the annual total the "physiological constant" is obtained. If this law be applied in the present case the physiological constant is about 0.53 (Chillicothe 0.539, Bard 0.530, Chula Vista 0.526).



3) *Effect of sunlight*. — The percentage of sunshine at Puyallup (46.4) is much lower than that of the other stations, especially that at Chula Vista (68.4). Besides lowering the temperature, a low percentage of sunshine helps to lengthen the vegetative period till it may, as at Puyallup, prevent ripening altogether.

4) *Effect of high temperature on flowering and the formation and ripening of seeds*. — High temperatures at the beginning of flowering are detrimental to the plant and decrease the yield considerably. In 1915 the seed was sown in April so that flowering and fruiting occurred in the middle of summer, at high temperatures, and the yield in grain was low. In 1916 sowing was in mid-June and flowering and fruiting at the end of summer and in autumn respectively, when the temperature was much lower, and a good yield was obtained. Sowing should be timed so that flowering and fruiting will take place under favourable climatic conditions.

1329 — *The Influence of Rainfall on the Fruit Crop in Norway*. — SEARD, A. M., in the *Tidsskrift for det Norske Landbruk*, Year XXV, Part. 8, pp. 305-332. Christiania, 1918.

Apples and pears can be successfully grown in the following regions of Norway :— North Bergenhus, Jarlsberg and Larvik, Nedenes, Smaalene, Lister and Mandal, Buskerud, Stavanger, Hedemarken, Akershus, Bratsberg, South Bergenhus, Kristians, Romsdal, South and North Trondhjem.

The average crops from 1907-1916 were sufficient for local needs. But there is the serious disadvantage, that the crop varies greatly year by year, thus largely exposing the market to foreign competition. Thus, taking the average crop as 100 we get :— in the Buskerud, 125 % in 1909 and 41 % in 1916 ; at Lier, 150 % in 1909-11 and only 30 % in 1916 ; in Balestrand, 150 % in 1911 and 70 % in 1916.

Thus there are years in which the supply exceeds the demand and others when the supply is completely insufficient. To avoid these difficulties, the factors of the variations given above must be known and, given that these variations persist while the conditions of soil and crop remain unchanged, it is obvious that the primary cause of the phenomenon must be sought in the weather conditions.

The author gives the results of a series of researches on the relationship between the yield in fruit and the rainfall. The following localities (centres of production) were studied : — Faaberg, Furnes, Edsvold, Vestre Aker, Rygge and Moss, and Norderhov, all situated in south-eastern Norway (Åstlandet).

From the examination of abundant observations it was concluded : — 1) that there is a direct ratio, a positive correlation, between the crop-yield and the rainfall from March to June of the previous year ; 2) that there is an inverse ratio, a negative correlation, between the crop-yield and the rainfall of September-October of the previous year. In spring the plant requires a large amount of plastic material so as to satisfy the needs of intense and quick growth :— leafing, flowering, setting, formation of flower buds for the following year. The absorption of material from the soil is subor-

dicated to the presence of water in sufficient amount to dissolve and carry such material.

Insufficient moisture at this moment is fatal to the plant ; part of the very young fruit becomes detached on account of lack of food material, and the next year's fruit buds develop badly or incompletely, resulting in a poor spring flowering. From this it will be seen that there is a positive correlation between the fruit crop and the total rainfall from March to June.

During the second half of summer and the beginning of autumn, dry, warm weather is required to mature the spring wood, the fruit, the fruit buds, and the store of reserve materials necessary for recommencing growth in the following spring. When this period is damp and rainy growth continues longer, to the detriment of the reserve material. As a result there is a) *incomplete maturity of the buds and wood and also, in consequence, decreased resistance to cold* ; b) *an insufficient store of reserve materials and, in consequence, limited and poor flowering in spring*.

There is, therefore, a negative correlation between the fruit crop and the total rainfall from September to October. Below are given the data for the Faaberg region, the rainfall data being taken from the nearest meteorological station, that at Lillehammer.

*Data showing the existence of a ratio between the fruit crop and the total rainfall for the periods March-June and September-October (average rainfall : March-June 169 mm ; September-October, 125 mm).*

Yield		Rainfall		
Years	in % of the average	Years	March-June	September-October
1909	150 %	1908	138 mm	48 mm
1911	130	1910	260	56
1914	120	1913	142	42
1913	115	1912	178	119
1915	80	1914	175	67
1907	40	1906	157	113
1908	25	1907	238	135
1910	20	1909	171	169
1912	30	1911	145	134
1916	20	1915	71	36

There are similar conditions in other localities. A good crop does not always correspond to abundant spring rain or too little summer-autumn rain. The number of flowers does not mean a corresponding number of fruits ; the action of late frosts at the moment of flowering and mists during setting may ruin the crop, even though flowering has been most abundant. This explains the variations in the above Table. As the north and west are gradually approached, with the increase of the total rainfall during all the

year, the ratio existing between the rain and the fruit crop disappears, whilst the action of other factors and weather conditions is plainly shown.

On account of the preponderating action of the rainfall the author gives the following advice to fruit growers in Östlandet: —

- 1) Choose varieties very resistant to drought.
- 2) Work the soil deeply so that the plant's roots can grow in length, thus utilising the water stored in the deep layers.
- 3) Give the preference, as intercrops, to potatoes, leguminous plants, carrots, etc. These plants have, at any rate in Norway, only a limited growth up to mid-June and thus only remove a limited quantity of water from the soil. During summer, on the contrary, and at the beginning of autumn, the foliage increases rapidly owing to the absorption of large quantities of water, of which the fruit trees are deprived with advantage.

1330 — Influence of Nutritive Salts on the Resistance of Plants to Cold. — See No. 1340 of this Review.

1331 — Recent Investigations on Soil Aeration. — I. HALL, A. D., *Phil. Trans.*, B., 204, 1913. — II. HUNTER, C., *Proc. of the Univ. of Durham Phil. Soc.*, IV, p. 183. — III. HOWARD, A., *Agr. Research Institute, Pusa, Bulletin* 61, 1916. — IV. RUSSELL, E. J., and APPELYARD, A., *Jour. of Agr. Sc.*, VII, p. 1, 1915. — V. HOWARD, A. and HOWARD, G. I., C. *Fruit Experiment Station, Quetta, Bulletin* 4, 1915. — VI. *Annual Report of the Imperial Economic Botanist*, 1916-17. — VII. RUSSELL, E. J. and APPELYARD, A., *J. of Agr. Sc.*, VIII, p. 385, 1917. — VIII. *Agr. J. of India*, Science Congress Number, p. 20, 1917. — IX. CANNON, W. A. and FREE, E. E., *Journal of Ecology*, V, p. 127, 1917. — X. HOLE, R. S., *Ind. For. Mem.*, I, p. 46, 1911. — XI. *Ind. Indian Forester*, p. 343-344, 1916. — XII. *Ind. Indian Forest Record*, V, p. 38, 1914. — *Abstract by HOWARD, A. (Imperial Economic Botanist) and HOLE, R. S. (Imperial Forest Botanist), Indian Science Congress, Lahore, 1918 (1).*

SOIL PHYSICS,  
CHEMISTRY  
AND  
MICROBIOLOGY

The growth of a crop is only possible through the simultaneous operation of a number of soil factors — water, mineral salts, temperature and oxygen. If any one factor is in defect, or in excess as in the case of temperature, growth is regulated by the amount of this factor present, and is not influenced by an increase in any of the other factors. The chief object in soil management is the removal, in advance, of any possible limiting factor.

The aeration of the soil is a factor in growth which has been neglected in the past. It has only indirectly been recognised in the importance attached to a proper soil texture. The subject is not attracting more attention and it is proposed to refer to some of the recent work and to indicate the directions in which further investigation is desirable.

AERATION AND THE AMOUNT OF GROWTH. — Various determinations have been made of the amount of growth in cultures in which the only variable factor is the degree of aeration.

1) *The effect of increased aeration on the root development of barley.* — In water cultures, HALL (1) found that both root development and growth depend on the amount of aeration.

(1) See R., 1914, No. 12; 1915, No. 571; 1917, Nos. 790 and 795. (Ed.)

2) *The effect of soil texture on growth.* — HUNTER (II) found that root development and growth fell off as the soil was more consolidated.

3) *The effect of adding potsherds or sand to the Pusa soil (III).* — The addition of inert aerating agents like sand, potsherds or broken bricks to Pusa soil (a fine calcareous silt which readily loses its texture) increases the growth very markedly. In the case of Java indigo, where both nitrogen and oxygen are required, the increase is as high as 40 %. To follow the subject further, the structure of the soil must be considered in relation to the root development of the plant. The pore spaces of the soil are taken up by air and water, the latter occurring in thin films round the soil particles. The biological activities of the root hairs and of the soil bacteria involve respiration for which a constant supply of oxygen is necessary and which results in a continuous production of carbon dioxide. Efficient soil ventilation is therefore essential for growth. Recent investigations at Rothamsted (IV) on the composition of the soil atmosphere show that the amount of oxygen in the soil falls as the amount of carbon dioxide rises. The water films contain little oxygen but much carbon dioxide, that is, the oxygen is used up as rapidly as it is supplied.

**VENTILATION OF THE SOIL, AND THE SYSTEM OF FLOOD IRRIGATION IN NORTHERN INDIA.** — Flood irrigation on fine alluvial soils interferes with their ventilation by rapidly destroying the texture and by forming a compact surface crust impermeable to air. One limiting factor — water — is removed but another — the need of aeration — is introduced. Thus over-irrigation actually diminishes the yield. This is shown by results obtained at Quetta where 13 maunds of wheat were obtained with one irrigation and only 8 maunds where three irrigations were given. In any flood irrigation system, a practical compromise between the needs of the plant for air and for water must be worked out. This has been accomplished at Quetta (V) by the proper utilisation of the preliminary watering given before sowing. Under this new system, the yields obtained are often higher than those obtained with the 6 or 7 waterings usually applied. The Quetta results have been shown by experiment to apply to the Punjab (VI) and Sind where almost half the irrigation water now used could be saved. The economic significance of these results becomes apparent when it is remembered that the annual revenue derived from irrigation works in India is £ 5 000 000.

**SOIL, AERATION AND QUALITY.** — It is well known that the quality of vegetable products varies with the locality, but the factors on which quality depends are still undetermined. Breed is undoubtedly one of the most important, and no improvement in cultivation can change a short-stapled cotton into a longstapled kind. Various observations suggest that for each variety to attain its highest quality, adequate soil aeration is necessary. A few examples may be given: —

1) *Barley* — The best malting samples are always grown on open well-aerated soils and never on stiff heavy clays.

2) *Tobacco* — All the tracts in India which have achieved a reputation for the production of tobacco of good quality are those in which aeration is above the average.

3) *Cotton* — Mr. CLOUSTON's results on the open laterite soils at Chandkhuri indicate that soil aeration is one of the factors on which the quality of the staple of cotton depends.

Experience in India shows that crops will not mature properly if soil aeration is interfered with during the ripening period. Recent results obtained at Rothamsted (VII) show that, on cropped land, ripening is associated with a great outpouring of carbon dioxide into the soil atmosphere. The cause of this is not known. It has been suggested that it is due to the death and decay of the fine roots after the flowering period, but this will not explain the observed delay in ripening if air is not supplied during the period of maturation. An interesting field of research lies ready to hand.

OTHER ASPECTS OF SOIL AERATION. — If soil aeration is a growth factor, aeration must influence the distribution of plants, as of grain in India (VIII), and be of importance in ecological studies. CANNON in Arizona and FREE (IX) of the Johns Hopkins University have shown that the poor conditions of soil aeration are correlated with the absence of vegetation in the dry lakes of desert basins, and the zonation of vegetation round these basins may be in correlation with the soil aeration requirements of the plants involved.

The importance of soil aeration in Indian forestry (X, XI, XII) has recently been emphasised by a study of the factors influencing the healthy growth of sal (*Shorea robusta*) seedlings. Whereas water cultures have shown that water in itself is quite harmless, yet water which is held in contact with sal forest soil rapidly becomes highly injurious to the roots of the seedlings. Any factor which increases the amount of moisture in the soil, such as shade or bad drainage, accentuates the injurious action. Rain-water held in contact with such soil is found to become heavily charged with carbon dioxide and impoverished as regards its oxygen supply. In water culture experiments, a high carbon dioxide and low oxygen-content have been proved to be injurious to the roots. There are good grounds for believing that, in addition to sal, many of the most important Indian trees are very sensitive to soil-aeration, and a careful study of this factor appears to be of primary importance in Indian forestry not only on account of its effect on the establishment and development of seedlings but also because of its probable influence on the growth of older trees and its possible connection with injurious diseases.

1332 — Copper and Zinc as Antagonistic Agents to the "Alkali" Salts in Soils. —

LIPMAN, C. B. and GERICKE, W. F., in the *American Journal of Botany*, Vol. V, No. 4, pp. 151-170 + 13 Tables + Bibliography of 11 Publications. Lancaster, Pa., April, 1918.

The antagonistic salt effect is now regarded as one of the established facts in plant physiology as in animal physiology. In the large amount of work done on the antagonism between salts, the heavy metals have received very little attention, while the alkali and alkali-earth metals have been tested in many ways. The authors consider the chief work on the heavy

metals (LOEB (1), CLARK, TRUE (2) and GIES, HAWKINS, LILLIE, etc.) and remark on the negative results obtained with copper and the lack of data, as far as regards the more important functions of plants, on the antagonistic action of that metal to the alkalis. As the authors had observed the stimulating effect of copper and zinc in certain cultures, they undertook to study the antagonistic action of copper (and of zinc, whose stimulating effect seems to indicate a similar method of action) to the toxic effects of "alkali" salts as regards the living cells of higher plants (3).

The plants used as indicators were a strain of barley (*Hordeum vulgare*). They were sown in pots and optimum and uniform moisture conditions were maintained in the soils. Some of the common salts of alkali soils, viz. chloride, sulphate and carbonate of sodium, were used as toxic agents, being added on a percentage basis of the dry weight of the soils. The antagonistic agents were the chlorides and sulphates of copper and zinc and copper carbonate, added to the salt-treated soils in quantities varying between certain limits (parts per million of dry soil). Two types of soil were employed, one sand, the other clay. The plants were grown to maturity, harvested, dried at 100° C., and weighed; the roots, stem and grain were weighed separately. The results were assembled in table form for each of the 7 series of cultures (including respectively:  $\text{CuSO}_4$  versus  $\text{Na}_2\text{SO}_4$ ;  $\text{CuCl}_2$  versus  $\text{NaCl}$ ;  $\text{CuCO}_3$  versus  $\text{Na}_2\text{CO}_3$ ;  $\text{ZnSO}_4$  versus  $\text{Na}_2\text{SO}_4$ ;  $\text{ZnCl}_2$  versus  $\text{NaCl}$ ;  $\text{ZnSO}_4$  versus  $\text{NaCl}$ ;  $\text{CuSO}_4$  versus  $\text{Na}_2\text{SO}_4$ ).

The authors state, without qualification, that the data they have thus obtained are the first evidence ever published of the antagonistic action between heavy metals and alkali salts. The antagonistic action is equally if not more marked when 4 ions are introduced into the soil, as in the case of the  $\text{CuSO}_4$  versus  $\text{NaCl}$  culture. Although only one crop was grown in sand, the majority being in clay, similar evidences of marked antagonism were noted.

The authors call attention to the importance of these results from the point of view of their possible practical application, an application that is also economic owing to the small quantities of the metals required to antagonise large quantities of alkali salts and, seeing that zinc is almost as effective as copper in the direction noted, this fact may indicate possibilities in the same line with other and cheaper metals.

1333 - The Effect of Heat on some Nitrogenous Constituents of Soil. — POTTER, R. S. and SNYDER, R. S. (Department of Soil Chemistry, Iowa Agricultural Experiment Station), in *Soil Science*, Vol. V, No. 3, pp. 197-223 + 4 Figs. + Bibliography of 17 Publications. Baltimore, March, 1918.

In investigations on the effect of heat on the nitrogenous constituents of soil only the ammoniacal and nitric nitrogen are usually estimated. The authors estimated the amino-acid nitrogen and soluble non-protein nitrogen as well. Three loam and one peat soils were subjected to the following treat-

(1) See R., Feb. 1915, No. 155. — (2) See R. Oct. 1915, No. 1020 (Ed.).

(3) For the limits of the tolerance of plant life for sodium salts contained in the soil, see R., Feb., 1917, No. 132. (Ed.)

ments : — a) Two hours' dry heat at 100° C., b) two hours' dry heat at 200° C., c) heating in the autoclave for 3 hours ; d) heating in the autoclave for 3 hours on 3 successive days. In each case the soils were inoculated with fresh soil emulsion and left to incubate for 10 and for 20 weeks respectively. A control series was not inoculated.

*Results.* — In all soils subjected to heat the ammonia increased as the temperature was raised ; in the peat soil heated to 200° C. excessive volatilisation of ammonia was observed. The amino-acid nitrogen gave results similar to those of ammonia except in the case of peat soils, which underwent very little change under the different treatments.

Dry heat at 100° C. modified very little the nitric nitrogen content of the soils, whereas heating in the autoclave increased it considerably in every case. Nitric nitrogen disappeared almost completely at 200° C. of dry heat. All treatments caused an increase of soluble non-protein nitrogen ; this increase was less marked in the peat soil.

In the three loam soils incubation for 10 weeks after treatment with dry heat at 200° C. caused an increase in ammonia. In two cases incubation for 20 weeks also caused an increase in ammonia, but to a lesser extent than incubation for 10 weeks ; in one case it decreased the ammonia. Incubation had very little effect on the ammonia content of peat soil subjected to dry heat.

Ten weeks' incubation always caused a decrease of amino-acid nitrogen, but a further ten weeks' incubation increased it. Nitric nitrogen increased during both periods of incubation. The soluble non-protein nitrogen in peat soil always decreased during incubation, but increased in loam soils heated to 200° C.

1334 — **Studies on the Correlation between the Production of Carbon Dioxide and the Accumulation of Ammonia by Soil Organisms.** — NELLER, J. R. (Dept. of Soil Chemistry and Bacteriology, New Jersey Agricultural Experiment Station), in *Soil Science*, Vol. V, No. 3, pp. 225-239 + 5 Figs. + Bibliography of 14 Publications., Baltimore, March, 1918.

As the decomposition of organic matter in soil is generally a biological process, it is measured by various indices of biological activity, the most common of which are plate-counting, ammonification and nitrification. Ammonia determinations being the easiest and supplying much data, the author studied the relation between ammonia accumulation and carbon dioxide production, between which there appears to be an optimum ratio on which the more or less favourable conditions of the soil depend. To this end the author studied the decomposition of organic matter in soils to which had been added both pure and mixed cultures of bacteria or fungi.

During a period of 12 days the production of carbon dioxide was found to be more uniform than the accumulation of ammonia but, as a rule, a greater production of carbon dioxide (with pure cultures) was accompanied by a marked accumulation of ammonia when 1 % of cottonseed meal or alfalfa were added to sandy loam. Pure cultures of fungi (*Aspergillus niger*, *Trichoderma*, etc.) oxidised more carbon, but caused the accumulation of much less ammonia than bacterial cultures. Soil infusions affected ammo-

nia accumulation in a way similar to fungi, but produced more carbon dioxide. Mixtures of pure cultures of bacteria showed no antagonism and in some cases a symbiotic relation appeared to exist.

It seems that when studying the optimum ratio between carbon-dioxide production and ammonia accumulation, other kinds of organic matter and the nature of the soils, as well as the effect of various manures and fertilisers should also be studied. The action of pure cultures of bacteria, actinomycetes, fungi, mixed so as to form a synthetic soil flora, also deserves study so that, in estimating the action of the natural flora of the soil, it may be possible to improve the soil and obtain from it the maximum yield without deterioration to it.

#### MANURES AND MANURING

**1335 - Nitrogen Fixation in Manure.** — I. TOTTINGHAM, W. E., (Wisconsin Agricultural Experiment Station, Madison), The Increase of Nitrogen in Fermenting Manures, in *The Journal of Biological Chemistry*, Vol. XXIV, No. 3, pp. 221-225. Baltimore, 1916. — II. FULMER, H. L. and FRED, E. B., (University of Wisconsin, Madison), Nitrogen-Assimilating Organisms in Manure, in *the Journal of Bacteriology*, Vol. II, No. 4, pp. 423-434. Baltimore, 1917.

I. — Various investigations (lasting from two to several months) on fermenting manure have nearly always shown more or less considerable loss in nitrogen; an increase in nitrogen has but rarely been observed (1). During recent work on the changes in a fermenting mixture of cow and horse manure an increase in nitrogen was observed after two and four weeks. This increase was followed by so large a decrease that after twelve weeks the loss in nitrogen was complete. The increase in the nitrogen content is much greater in straw-littered than in unlittered manure.

This fixation phenomenon was confirmed by laboratory control tests. The manure mixture was kept either in covered galvanised iron pails or inoculated with mannite or other solutions. The results showed manure to contain nitrogen-fixing bacteria of considerable activity, especially when mixed with straw, which appears to be an important source of energy for these microorganisms. It is obvious that the increase of nitrogen in manure at the beginning of fermentation may prove of practical value in manuring soil if this increase is not counter-balanced by a simultaneous loss in organic matter. Experiments with straw-littered manure (gathered fresh and placed in covered boxes out of doors during the winter months so as to limit fermentation) applied to a rotation of maize, barley and clover, showed such manure to increase the yield in maize grain by 5.3 % and the yield in maize stover by 7.4 %, as compared with fresh manure with straw. This difference disappeared with barley and was reversed with clover. The results of these experiments, which lasted six years, were in favour of limited fixation of manure if the nitrogen so fixed can be utilised at the time of application.

II. — Later experiments made with liquid and solid cultures showed nitrogen fixation in fermenting manure to be due to certain forms of bacteria which appear to belong to different groups. The chief agent of nitrogen

(1) See R. Sept. 1917, No. 797. (Ed.)



fixation in manure, however, seems to be *Bacterium azophile* n. sp., present in large numbers in fermenting manure. The increase in nitrogen when this bacterium is grown on manure extract is from 3 to 5 mg. per 100 cc. of solution. The optimum temperature for the development of nitrogen fixing bacteria in manure appears to be 28°C. *Bact. azophile* seems to be widely distributed in nature.

- 1336 - **The Possibility of Obtaining Nitrogenous Fertilizers by Utilising Waste Materials for the Fixation of Nitrogen by Nitrogen-Fixing Bacteria.** — DORVLAND, C. I. T. (Scientific Proceedings of the Society of American Bacteriologists), in *Abstracts of Bacteriology*, Vol. II, No. 1, p. 2. Baltimore, 1918.

While studying the energy relations of a soil flora experiments were made to determine which waste materials might serve as sources of energy for nitrogen-fixing bacteria. It was found that nitrogen fixation took place when either molasses, orange juice, lemon juice, grape fruit juice, wheat, oat, barley, rye or flax straw were used as sources of energy. Waste paper, wood wastes, grass residues and beet and cane sugar residues will probable serve in the same way. Under natural conditions nitrogen may be fixed by bacteria much more economically than by our present laboratory methods. The writer suggests that it is probable that the fixation of nitrogen by bacteria may be accomplished as cheaply as by electricity or even by a catalytic chemical process such as BUTCHER'S cyanide process. The production of cheap nitrogen by the bacterial process will be attained by utilising waste materials as sources of energy, together with the correct combination of symbiotic microorganisms and the development by selection of highly efficient nitrogen fixing strains. These must be combined with a simple mechanical manipulation, with final evaporation by solar heat. A modification of the rapid vinegar process for waste liquids and a modification of the activated sludge process for solid materials such as pulps, straws and waste paper are possible points of departure for mechanical manipulation.

- 1337 - **Studies on the Absorption of Ammonia by Superphosphate: "Ammonium Superphosphate"** (1). — BRIOTUX, C., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 21, pp. 632-638. Paris, June 12, 1918.

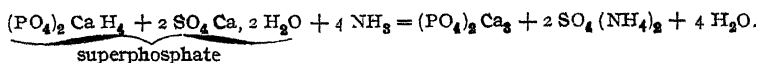
Since the war, the consumption of pyrites and sulphuric acid has had to be limited everywhere in Europe, especially for the manufacture of manures. As this has been particularly the case in Germany, in that country the sulphuric acid required to absorb the ammonia to produce the sulphate has been suppressed, and the ammonia (obtained from sewage-water, gas water or cyanamide) is absorbed by calcium superphosphate made with sodium bisulphate, a bulky and worthless residue of powder works. In this way a new phosphatic and nitrogenous manure has been obtained which is called, in the lack of another name, "ammonium superphosphate" and which will act on the plant contemporaneously with all its nitrogen and all its phosphoric acid, in spite of the reverted state of the latter.

As this new manure is of interest under present conditions, the author

(1) See R., March 1916, No. 272. (Ed.)

has prepared a small amount to study its chemical properties, his observations being summed up in the present paper.

When insoluble tricalcic phosphate is attacked by sulphuric acid we get calcium sulphate and calcium acid-phosphate which corresponds to one molecule of phosphoric acid for one molecule of lime instead of three. If the superphosphate is treated with ammonia gas, the latter does not saturate, as one might expect, the acidity of the phosphate; it acts on the calcium sulphate, forms ammonium sulphate and reconstitutes the tricalcic phosphate, the reaction being as follows:—



It would thus seem that there is a grave disadvantage; water-soluble phosphate had been formed and then rendered insoluble again. But the author points out that the cohesion of this tricalcic phosphate is not the same; it has become such that it dissolves almost integrally (after preparation) in ammonium citrate and 2 % citric acid. The superphosphate used for the tests had the following chemical composition:—total  $\text{P}_2\text{O}_5$ , 15.60 %;  $\text{P}_2\text{O}_5$  soluble in ammonium citrate, 14.56 %; water-soluble  $\text{P}_2\text{O}_5$ , 13.03 %. After saturating with ammonia gas and leaving in a thin layer to air dry for some hours, the composition was:—total  $\text{P}_2\text{O}_5$ , 15.80 % (1);  $\text{P}_2\text{O}_5$  soluble in ammonium citrate, 13.10 %; water-soluble  $\text{P}_2\text{O}_5$ , 1.53 %;  $\text{P}_2\text{O}_5$  soluble in 2 % citric acid, 14.10 %; ammoniacal nitrogen, 4.97 %.

As regards the solubility of its phosphoric acid in the usual reagents, "ammonium superphosphate" can, therefore, be considered as superior to basic slag.

It is true that the cohesion of the tricalcium phosphate obtained increases little by little with time and that the citrate solubility diminishes, but the new product remains soluble in 2 % citric acid.

The author has made no cultural tests, but he points out that such tests gave good results in Germany. Besides, the solubility of "ammonium superphosphate" in weak reagents shows that it should be easily dissolved by the agents in the soil.

1338 — Production of Calcium Phosphate at Curaçoa. — *Handelsberichten*, Year XII, No. 595, p. 286; No. 591, p. 231. The Hague, 1918.

The calcium phosphate found at Curaçoa and in the two neighbouring islands, Aruba and Bonaire, is mostly derived from guano and marine animals.

These phosphates have been long worked, with great fluctuations and even stoppages. In the island of Aruba the working was begun in 1881 and attained its maximum in 1907 when 35 000 metric tons were exported. In the island of Curaçoa the highest exportation (32 000 metric tons) was made in 1884.

(1) Content slightly higher than that of the primary superphosphate on account of the loss of the water of crystallisation of the calcium sulphate; for 17 gm. of ammonia fixed, 18 gm. of water are displaced. (*Author*.)

[1327-1338]

Owing to the exceptional conditions created by the war, the exportation has decreased enormously, as is plainly shown by the following figures, giving exportation from the "Colonie de Curaçoa": — in 1913, 34 772; in 1914, 21 720; in 1915, 31 308; in 1916, 14 468; and in 1917, 4 000 metric tons.

1339 — On the Diffusion of Aluminium-Ions in the Plant World. — STOKLASA, J. with the collaboration of SEBOR, J., ZDOBNICKY, W., TYMICH, F., HORÁK, O., NEMEC, A., and CWAC, J., in the *Biochemische Zeitschrift*, Vol. 88, Pt. 4, pp. 292-322 + 10 Tables + Bibliography of 17 Publications. Berlin, 1918.

AGRICULTURAL  
BOTANY,  
CHEMISTRY  
AND  
PHYSIOLOGY  
OF PLANTS

The author had long studied the diffusion of aluminium in the plant world (1) and its physiological function. In the present paper he gives the results of the latest researches he has carried out with his collaborators, results that shed new light on the function of aluminium in the various ecological categories of the plant world, that is, 1) xerophytes; 2) hydrophytes and hygrophilous plants; and 3) mesophilous flora.

Before giving his results, the author rapidly considers the literature on the subject, showing the great divergence existing between the opinions regarding both the diffusion and function of aluminium in the plant world, which renders these researches very timely.

The author has obtained most abundant and varied material from nearly every European country. Before analysis the plants were carefully washed, especially the roots, and air dried. The data obtained for each species are given in numerous tables giving the percentage of ash in the dry matter, the percentages of iron oxide and aluminium oxide respectively in the ash and in the dry matter. The material was naturally grouped according to its ecological nature and the general results obtained for each of the 3 groups thus established may be summarised as follows: —

I. — XEROPHYTES. — The xerophilous flora is distinguished by the low content of all the organs of the plant in aluminium-ions. Occasionally barely traces of aluminium-ions can be found, e. g., in the flowers and seeds of Phanerogams, which, at the most, show traces of aluminium oxide. The absorption of very small quantities of the aluminium-ions of the soil constitutes a physiological property characteristic of the xerophilous flora.

I. — HYDROPHYTES AND HYGROPHILOUS FLORA. — The inverse holds good for hydrophytes and hygrophilous plants, which are characterised by a high aluminium content, especially the algae, as is shown by the following amounts of  $Al_2O_3$  contained in the dry matter: — in the Chlorophyceae, *Bryopsis* n. sp., 1.414 % and *Halimeda opuntia*, 1.419 %; in the Phaeophyceae, *Sargassum bacciferum*, 1.512 %; in the Rhodophyceae, *Delesseria*, 2.332 %. In the higher plants the root contains much more aluminium oxide than the epigeal part; thus, in the Equisetaceae, the dry matter of the root may contain from 1.737 to 1.775 % of aluminium oxide, and that of the epigeal part, 0.345 to 0.478 %. The same difference, often still more accentuated, occurs in the Lycopodiaceae, Cyperaceae, Polygonaceae, etc., all

(1) See R., January, 1914, No. 21. (Ed.)

very rich in aluminium. Many hydrophytes and hygrophilous plants contain in the dry matter of their root system from 0.104 to 0.766 % of aluminium oxide and in that of their epigeal part from 0.018 to 0.276 %. The flowers and seeds of the phanerogams analysed always contained aluminium, however, sometimes even in notable quantity. The general biological economy of the organism of hydrophytes and hygrophilous plants shows that the absorption by the cell of the aluminium-ions of the water or soil constitutes a special physiological requirement for these plants. The physiology of the cell here includes a special selective faculty, quantitatively determined for the aluminium-ion, which is concentrated in the higher plants in the roots, rhizomes, tubers or bulbs. In these higher plants, it is the general rule that the epigeal part always contains less aluminium-ions than the subterranean part. The absorption of considerable quantities of aluminium-ions and their deposit amongst the reserve material in seeds forms a characteristic physiological property of the aquatic and hydrophilous flora.

III. — MESOPHILOUS FLORA. — Plants growing in an environment of average humidity and which can be modified within certain limits, belong to the "mesophilous flora" (e.g. certain Graminaceae, Papilionaceae, Caryophyllaceae, etc.). When these plants grow in a rather dry environment the root and epigeal systems are extremely poor in aluminium ions; on the contrary, the same plants, growing in a damp or marshy soil accumulate, especially in their roots, notable quantities of aluminium ions.

There thus seems to be a well defined relationship between the diffusion of the aluminium ions in the plant world and the edaphic and ecological factors.

1340 — Experiments on the Resistance of Plants to Cold. — PANTANELLI, E., in *Atti della Reale Accademia dei Lincei*, Series V, Vol. XXVII, Pt. 3, pp. 126-130; Pt. 4, pp. 148-153. Rome, 1918.

Experiments were made with cultures in pots, each of which contained several plants. The pots formed a series of ten, receiving food salts in the following order, making it possible to distinguish the ions most important for the metabolism of the plant: —

- Pot 1) Control, spring water containing chiefly bicarbonate of lime.
- Pot 2)  $\text{NaNO}_3$  (nitric nitrogen; cation with little or no food value).
- Pot 3)  $(\text{NH}_4)_2\text{CO}_3$  (ammoniacal nitrogen; anion negligible).
- Pot 4)  $\text{KHCO}_3$  (potassium; anion negligible).
- Pot 5)  $\text{KNO}_3$  (potassium and nitric nitrogen).
- Pot 6)  $\text{KH}_2\text{PO}_4$  (potassium and phosphoric acid).
- Pot 7)  $\text{MgSO}_4$  (magnesium and sulphuric acid).
- Pot 8)  $\text{Na}_2\text{SO}_4$  (sulphuric acid; cation with little or no food value).
- Pot 9)  $\text{NaNO}_3 + \text{KH}_2\text{PO}_4$  (complete fertiliser; nitric acid, potassium and phosphoric acid).
- Pot 10)  $\text{NaNO}_3 + \text{KH}_2\text{PO}_4 + \text{MgSO}_4$  (complete formula; potassium, magnesium and sodium).

I. — EXPERIMENTS MADE AT TEMPERATURES BELOW FREEZING POINT. — The plants (wheat, beet and sunflower) were grown in cold greenhouses from

January to April and then exposed to temperatures low enough to cause freezing. Wheat and beet, taken from an external temperature of  $11^{\circ}\text{C}$ ., were cooled to  $-4.5^{\circ}\text{C}$ . in 5 hours. The temperature was then raised to  $6^{\circ}\text{C}$ . in 14 hours and, finally, the plants were warmed to room temperature. The sunflower plants, taken from a temperature of  $12^{\circ}\text{C}$ ., were cooled in 3 hours to  $-3.5^{\circ}\text{C}$ ., and kept at that temperature for 2 hours. The temperature was then raised to  $6^{\circ}\text{C}$ . in 15 hours and the plants finally brought to  $12^{\circ}\text{C}$ .

II. — EXPERIMENTS MADE AT TEMPERATURES ABOVE FREEZING POINT.

— The plants (tomato and maize), grown in a cold greenhouse from April to July heated daily to as much as  $38^{\circ}\text{C}$ ., were then exposed to temperatures a little above  $0^{\circ}\text{C}$ . so as to avoid freezing.

CONCLUSIONS. — 1) No immediate relation was observed between resistance to cold and the food value of the salts supplied to the plants. Nitrates diminished the resistance to cold most. Potassium and phosphoric acid inhibited the unfavourable action of the nitrates, but did not increase the resistance of the plants.

2) No relation between growth and resistance to cold was found.

3) No relation was found between the molecular concentration of the cell sap (determined by the cryoscopic method) and resistance to cold. The maize plants which resisted best were those which increased or maintained high osmotic pressure of the cell sap during cooling.

4) There is no relation between resistance or the density of the cell sap in wheat and beet. The most resistant sunflower, tomato, and maize plants were those the cell sap of which was richest in extract.

5) The proportion of mineral principles dissolved in the cell sap does not influence the resistance but, in the case of the tomato, the cell sap of the most resistant plants was poorer in minerals. During cooling the mineral principles of the most sensitive maize plants dissolved.

6) There was no relation between resistance and the proportion of free or combined acids present in the cell sap before cooling, during which the acidity of maize and tomato increased.

7) Before cooling no relation could be found between the resistance and the sugar or plastic carbohydrate contents. Nevertheless, the plants which suffered most were those which, during cooling, disposed of the least sugar, either because much of it had been destroyed or because sufficient starch was not dissolved.

Resistance to cold has, therefore, no connection with the concentration of the cell sap, nor with its content in acids or salts, but with the amount of sugar retained by the cell during cooling. The author intends to study whether the sugar acts only as a source of energy or if it protects the protoplasm against autolysis, as appears to be the case by its strong anti-proteolytic action.

8) These relations were observed in cases of death by freezing as well as in those of death by cooling only. In both cases the drying up of the organs was proportionate to the deterioration suffered, and always occurred although the environment was saturated with moisture.

**1341 - The Influence of the Physiological Condition of the Seed upon the Course of Subsequent Growth and upon the Yield; the Effects of Soaking Seeds in Water (1).**

— KIDD, F., and WEST, C., in *The Annals of Applied Biology*, Vol. V, No. 1, pp. 1-12 + 10 Tables + 5 Figs. Cambridge, July, 1918.

Of late years in most researches dealing with the Seed the attention has been almost entirely concentrated upon the question of germination, while little attention has been paid to the eventual influence of treating the grain, which would show how far the physiological condition of the plant in the seed-stage may exert a pre-determining influence upon the whole subsequent course of growth and development. This importance of this question is obvious when it is said that the yield from an equal number of plants of a pure line may vary 50 % or even more, owing to the pre-determining influence of the physiological condition of the seed as affected by environmental conditions both before and during germination.

The authors undertook to study this predetermining influence and, in the present paper, give the first results obtained by immersing the seeds in water at 17°C. for 8, 24, 48 and 72 hours. The seeds used were those of the pea (*Pisum sativum*), dwarf bean (*Phaseolus vulgaris*), barley (*Hordeum*), sunflower (*Helianthus annuus*), white mustard (*Brassica alba*), broad bean (*Vicia Faba*), white lupin, wheat and oats. The effects observed on the rate of germination of the various samples thus treated, as well as on the yield of the plants obtained (length of stem and root), lead to the conclusion that *soaking the seed in water may have a marked effect on the subsequent growth of the plant*. The nature of the effect is strongly *specific*, quite different results being obtained by similar treatment upon closely allied plants, as is shown very strikingly by beans. The results of soaking the seeds of the dwarf bean even for 6 hours becomes evident after a month's growth by a decrease of 26 % (as compared with control plants set dry) in the dry weight yield of the tops of the plants. Seeds of the same species, soaked in water for 24 hours before sowing, showed the most rapid and vigorous germination, while later, 12 days after sowing, the total length of these plants as compared with the controls set dry was as 2.4 : 13.8.

The results obtained with the Broad Bean are quite different: the effect of soaking the seeds was found to be increasingly beneficial, not only on the percentage of germination, but also upon the size of plant produced. Thus, 3 weeks after sowing, the average height of the plants produced from seeds planted dry was only 4 cm. as compared with 10.4 cm. in the case of those soaked for 3 days before sowing.

The photographs accompanying the article show clearly the effect of soaking the seed on the growth of the plants.

**1342 - The Influence of Temperature on the Germination of the Seeds of the White Mulberry.** — ACQUA, C., in *Informazioni seriche*, Year V, No. 8, pp. 131-132. Rome, April 20, 1918.

Laboratory germination tests of white mulberry seeds, distributed gratis by the Italian Ministry of Agriculture, for forming "prati di gelso"

(1) See also R., June, Aug. and Sept. 1917, Nos. 533, 717 and 804. (Ed.)

(dwarf-plant plantations). In practice, a germination percentage of 50 % is satisfactory.

The tests show that, at 20°C., germination commences on the 5th day, taking place gradually, so much so that a final total of 23 % is obtained. At 25°C., germination begins on the 4th day, and the total is 34 %. The optimum is obtained at 30°C., with vigorous germination on the third day and a total of 62 %. At 35°C., there is diminished intensity (a total of 50 %) and, at 40°C., germination ceases. The influence of the temperature is, therefore, important, and growers should take it into account.

The experiments all show that the seeds are not harmed when they remain at a low temperature in a damp room or in the soil, as happens, for example, with autumn sowing. Growers should not be alarmed, therefore, if the season is cold and the young plants do not appear; cultivation should, on the contrary, be continued. But it may be more advisable to delay sowing until the temperature is sufficiently high to assure more rapid germination. It is not necessary to wait for the optimum temperature and a lower temperature may even be considered as sufficient, provided it is not too low.

As regards the amount of heat necessary for completing germination, the author shows that the nearer the favourable conditions of temperature are approached that amount is smaller.

It still remains to be seen whether the young plants obtained by using various quantities of heat have the same strength and subsequently develop equally quickly. The author is continuing his researches on this subject.

1343 - Mutation Observed in a Pure Strain of Two-Rowed Barley (*Hordeum distichum* L.), in Bavaria. — KIESSLING, L., in *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. XIX, Pt. 3, pp. 145-159. Leipzig, June, 1918.

PLANT  
BREEDING

In 1912 the author described a new variety of two-rowed barley obtained by mutation in the Vriesian sense in the 9th generation of a pure strain of *Hordeum distichum* described by the symbol Fg2. The new variety, described by the symbol Fg3, has the following characters:—

- 1) Leaves pale green as a result of decrease in the amount of chlorophyll and the number of chromatophore cells and chloroplasts.
- 2) More abundant tillering and greater development of foliage.
- 3) Longer ears and awns, shorter, but more numerous internodes, lighter straw.
- 4) Higher yield in grain.
- 5) High water content of the vegetative parts, lower resistance to cold, greater susceptibility to the action of external agents.

Numerous methodical observations and investigations made since 1912 show this variety to have remained absolutely constant so far, transmitting its characters integrally from generation to generation. It is, therefore, for unknown reasons, a true mutation, i. e. an unexpected hereditary variation. To what category of mutations does it belong? Is it a case of *progressive mutation* due to the appearance of new factors (determinants) capable of influencing the manner of growth and the formation of tissues, or a *mutation by loss* due to the disappearance of one or more factors?

The most striking character of the mutation is lack of chlorophyll with which, as easily explained physiological correlations, might be connected the other differential characters, or at least, many of them. The appearance of the new variety could then be explained by the loss of one or more of the factors governing the formation of chlorophyll. To prove whether this be really so the author made hybridisation experiments from 1911 onwards.

The mutated plant Fg3 was twice crossed with the parent Fg2, first, in 1911, in the sense Fg3 ♀ × Fg2 ♂, then, in 1912, in the sense Fg2 ♀ × Fg3 ♂. The hybrids of the  $F_1$  of both of these crosses were of a distinctly darker green than the form Fg3 and it was not possible to distinguish them with certainty from the Fg2 form. In the  $F_2$  generation the averages from ten determinations were: — 2370 pale green plants, 9073 green (intermediate colour) plants, and 2591 dark green plants. The figures correspond to the Mendelian ratio 0.7:2.6:0.7. The theoretical ratio would be 1:2:1 (the excess of plants of intermediate colour being attributable to the fact that all doubtful cases were usually placed in this category). This ratio is that of a monohybrid.

If the designation  $G^x$  is given to the chlorophyll factors common to the two forms Fg2 and Fg3 and the designation  $G^v$  to the factor which has disappeared in the Fg3, the following gametic formulae are obtained:—

$$Fg2 = G^x G^x G^v G^v \quad Fg3 = G^x G^x g^v g^v$$

$F_1 = G^x G^x g^v g^v$  (darker than Fg3 and probably lighter than Fg2).

$$F_2 = 1 \underset{\text{as dark as Fg2}}{G^x G^x G^v G^v} + 2 \underset{\text{intermediate}}{G^x G^x G^v g^v} + 1 \underset{\text{as light as Fg3}}{G^x G^x g^v g^v}$$

This would confirm the hypothesis of mutation by loss though it would be impossible to say whether  $G^v$  had really *disappeared* or was merely *latent*. In none of the numerous hybridisation tests did this factor reappear even sporadically. It therefore seems probable that the homozygous plant, Fg3, lost not only one factor, but a pair of factors.

As has already been said, the Fg3 form is distinguished not only by the colour of its leaves, but also by other characters, the existence of which may be considered to be an effect of loss of chlorophyll. Thus, the foliage tends to develop more to make up for the loss of assimilating power of the green surface, the total water content increases, the number of stomata decreases, etc. Nevertheless all these adaptations do not entirely compensate for the deficiency of chlorophyll, and the yield in grain of Fg3 remains inferior to that of Fg2. Moreover, the low resistance to cold of Fg3 is clearly connected with the higher water content of its tissues.

1344 - The Relation between Colour and other Characters in Certain Avena Crosses. — LOVE, H. H. and CRAIG, W. T., in *The American Naturalist*, Vol. LII, Nos. 620-621, pp. 369-383. New York, August-September, 1918.

The paper under review gives the results of a series of crosses between *Avena fatua* and *A. sativa* made in order to study the inheritance of awn development, glume colour and pubescence.

CHARACTERS OF THE PARENTS. — *Avena fatua*: — glumes brown or



black, many awns, pubescent both inside and outside. *Avena sativa*: — pale yellow glumes, glabrous and few or no awns.

$F_1$ . — Characters intermediate between those of the parents, brown glumes, inner kernel always without awns, but with sparse dorsal hairs.

GLUME COLOUR IN  $F_2$  AND  $F_3$ . — In  $F_2$  there were three colour types, 310 black, 92 grey, and 18 yellow. Assuming *Avena fatua* to possess the factor determining black **B**, that of grey **G**, and that of yellow **Y**, i. e. the formula **BBGGYY**, and *Avena sativa* only the determinant **Y** and the formula **bbggYY**, the ratio in  $F_2$  should be 12 black-glumed plants: 3 grey glumed plants: 1 yellow-glumed plant. The numbers found (310:92:18) correspond fairly well to those calculated by this ratio (315.00:78.75:26.25), especially as the differences between the first and second are due to the difficulty of distinguishing clearly the plants with pale yellow glumes from those with pale grey glumes. If all the plants with glumes other than black are placed in one group, the ratio obtained is 310 with black glumes: 111 with grey or yellow glumes, corresponding to 3:1. This is confirmed by  $F_3$  which contains 230 black-glumed plants, 57 grey-glumed and 21 yellow-glumed ones.

RELATION BETWEEN COLOUR OF GLUMES AND DEVELOPMENT OF AWNS IN  $F_2$  AND  $F_3$ : — The percentage of awns was obtained by counting the total number of spikelets and the total number of awned spikelets and expressing the second as a percentage of the first. The following table shows these percentages in the black, grey and yellow  $F_2$  plants of the cross *Avena fatua* × *Avena sativa* var. Sixty Day.

		Percentage of awns											Total	
Colour of glumes		0	1-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100	
	Black	46	25	20	23	12	17	21	23	14	8	2	99	310
	Grey	11	9	6	10	3	10	6	5	1	3	—	28	92
	Yellow	9	7	1	1	—	—	—	—	—	—	—	—	18
	Totals	66	41	27	34	15	27	27	28	15	11	2	127	420

The black oats passed through all the different degrees from fully awned to awnless. The same may be said of the grey oats, except that the total number of awned plants is much lower. On the contrary, the yellow oats differed widely from the two preceding groups by the rareness of their awns the percentage of which did not exceed 30. It seems probable that the yellow factor has an inhibitory influence on the determination of awns. This hypothesis is confirmed by  $F_3$ .

RELATION BETWEEN COLOUR AND PUBESCENCE OF THE GLUMES IN  $F_2$  AND  $F_3$ : — The  $F_2$  of the cross *Avena fatua* × *Avena sativa* var. Sixty Day contained: —

a) 310 black plants, all pubescent, 112 on both glumes of the spikelet, 198 on one glume only.

b) 92 grey plants, 26 of which had pubescence on both glumes of the spikelet, 42 on one glume only, and 24 of which were completely smooth.

c) 18 yellow plants, all of which were perfectly smooth.

These facts show:—1) an incompatibility between yellow glumes and pubescence; 2) the probable existence of two factors for pubescence one of which is linked with the black colour factor. If this be so black oats would have two factors for pubescence, grey oats only one.

Assuming *Avena fatua* to have the formula **BB GG YY PP**, where **B** represents both the black colour factor and one of the two pubescence factors, the second one being expressed by **P**, the formula of *Avena sativa* var. Sixty Day would be **bb gg YY pp**, and its  $F_1$  hybrids with *A. fatua* **Bb Gg YY Pp**. These hybrids form 8 different gametes, the reciprocal combinations of which, taking the inhibitory action of **Y** into account, should give in  $F_2$  48 black pubescent plants, 9 grey pubescent plants and 4 smooth yellow plants. Between plants with pubescent and those with non-pubescent glumes there should be the ratio 57 : 7 (1), and of the 420  $F_2$  plants 374.06 should be pubescent and 45.94 smooth. The numbers found, 378 and 42, correspond very well with these theoretical numbers. The existence of two factors for pubescence, one of which is linked with the factor for black colour, is confirmed by an examination of  $F_3$ .

A series of crosses between *Avena fatua* and *Avena sativa* var. Tartar King gave in the  $F_2$  pubescent and smooth plants in the ratio 15 : 1 or 3 : 1. In the second case ANOTHER TYPE of *Avena fatua* wanting in the determinant **P** and having, consequently, the formula **BB YY GG pp** must be concerned. If this type is crossed with Sixty Day all the yellow and grey  $F_2$  hybrids are completely smooth. This second type of *Avena fatua* then has only one pubescence determinant, that linked with the black colour factor.

1345 — **Methods for Selecting and Improving the Cotton Plant, in Egypt**, — See No. 1356 of this Review.

1346 — **Apple Selection in Canada**. — MACOUN, W. T. (Dominion Horticulturist), in the *Federal Ministry of Agriculture, Canada, Dominion Experimental Farms, Horticultural Branch, Bulletin* No. 86, 154 pp. + 25 Figs. Ottawa, 1908.

As the demand for Canadian apples is continually increasing the Farms and Experimental Stations of that country have been working for some years with the object of obtaining good varieties that would do well in the climate of the North-West by working on 4 lines:—1) selection of seed; 2) acclimatisation and seed selection; 3) selection of bud variations; 4) crossing with wild or half-wild strains with a short vegetative period and very resistant to low temperatures.

1) SEED SELECTION. — By choosing from each tree fruit of good taste, size and colour and sowing their seeds separately, plants may be obtained that tend to retain and transmit the characters for which they were select-

(1) Not taking into consideration the inhibitory action of **Y** this ratio would be 15 : 1.

ed. In 1898 the Ottawa central Experimental Farm had an orchard containing about 500 varieties of apples which could produce countless combinations of characters owing to natural cross-pollination. The seeds of some apples of specially good taste and quality, especially the varieties Mac-Intosh, St. Laurent, Fameuse, Wealthy, Shiawassee, Swayzie, Winter Scott, Salome, Lawyer, Gano, Northern Spy, winter St Laurent, Bullock (American Golden Reinette) were gathered and sown separately. In this way over a thousand varieties were obtained, of which 378 are now showing good promise, particularly Brock, Joyce, Melba, Pedro (from the Mac Intosh variety); Diana, Gerald (from Langford Beauty); Donald, Elmer, Lipton, Niobe, Rocket, Thurso (from Northern Spy); Galetta (from Wealthy); Ramona (from Shiawassee Beauty).

2) ACCLIMATISATION AND SEED SELECTION. — In 1890, an orchard was started with 3000 plants obtained from seeds of apples grown to the north of Riga, Russia. The number of varieties thus obtained gradually diminished, finally forming a small group with notable resistance to cold, which gives to varieties of Russian origin at the north of the 45th parallel marked superiority over those coming from the United States, which, however, are better to the south of that latitude. The varieties worthy of note are Duchess of Oldenbourg, Transparent Yellow, Claire, Neville, Oscar, Percival, Roslin, Rupert.

3) SELECTION OF BUD VARIATIONS. — Some varieties are created by bud variations. Thus, on the Fameuse apple, one or more branches occur bearing apples that are redder than those on the other branches. The Banks red Gravensteins, originating from New Caledonia, are also due to a bud variation. Up to the present, however, but few variations of this kind have been registered.

4) CROSSING. — Several Canadian varieties of apple have been obtained by crossing. For some years this has been carried out at the Agricultural College and Horticultural Station of the province of Ontario, and it is quite probable that good varieties will be produced by this method.

In 1887, the year when the Experimental Farms were opened, that of Ottawa imported from the Botanical Garden of Petrograd (Russia) some seeds of *Pyrus baccata*, a wild apple very common on the banks of Lake Baikal and in other regions of Northern Siberia; this apple is very resistant to strong winds and produces fruits as large as a cherry, astringent, acid and sometimes bitter. These seeds were sown at the Ottawa central Experiment Farm and produced a large number of plants which were distributed to the Experimental Stations of Brandon (Manitoba) and Indian Head (Saskatchewan). In the 20 years during which this Siberian apple has been on trial it has never been damaged by cold. It is somewhat dwarf, with low branches and a strong trunk; the fruit are firmly attached, which explains its resistance to the high winds that are frequent on the prairies of North-West Canada.

In order to enlarge and improve the fruits of *Pyrus baccata*, Dr. W. SAUNDERS carried out, in 1894, a series of crosses between that species and the best Canadian apples, in order to unite in one and the same plant the cha-

racters of "good quality fruit" and "resistance to bad weather." Some of these hybrids are as hardy as *P. baccata*, while producing much larger fruit than those of that species. Cultural tests carried out in a number of localities of the North-West gave really encouraging results.

Similar results were obtained by crossing the best varieties of Canadian and Russian apples with *Pyrus prunifolia*, a wild apple very resistant to cold and producing fruit twice as large as those of *Pyrus baccata* (some botanists consider it as a distinct species, others as the hybrid *Pyrus Malus* × *P. baccata*).

In hybridisation tests with the two above mentioned species pollen of the following varieties was used: — Tetofsky, Duchesse, Wealthy, Anis, Beautiful Arcade, Broad Green, Excelsior, Fameuse, Golden Reinette, Haas, Herren, Krimskoe, Red Mac Intosh, White Mac Mahon, Osimoe, Pewaukee, Red Astrakan, Ribston Pippin, Winter Scott, Simbirsk No. 9, Swayzie, Grey Apple, Talman Sweet, Winter St. Laurent, Transparent Yellow.

After their multiplication and cultivation for some time in the North-West prairie regions, some of Dr. SAUNDERS'S hybrids have proved to be very hardy and they represent a considerable advance in the creation of resistant apples for the North-West.

The following varieties, distinguished by the size of their fruit (diameter from 1.2 to 1.8 in.), are worthy of note: —

Jewel ( <i>P. baccata</i> × Transparent Yellow)	Elsa ( <i>P. baccata</i> × Transparent Yellow).
Columbia ( <i>P. baccata</i> × Broad Green)	Eve ( <i>P. baccata</i> × Simbersk No. 9)
Charles ( <i>P. baccata</i> × Tetofsky)	Dean ( <i>P. baccata</i> × Wealthy).
Silvia ( <i>P. baccata</i> × Transparent Yellow)	Pioneer ( <i>P. Baccata</i> × Tetofsky).
Tony ( <i>P. baccata</i> × Mac Mahon).	

The seed progeny of these hybrids nearly all gave fruit smaller than that of the parents; this fruit was not big enough to stand comparison with those of the less hardy varieties. In order to obtain varieties with large fruit, while still sufficiently hardy to withstand open-air cultivation in the Prairie region, the above hybrids were again crossed in 1904 with the following good varieties of apple (providing the pollen): — Mac Intosh, Baldwin, Cranberry, Duchess, Northern Spy, October, Winter Scott, Simbirsk No. 9, Tetofsky, Transparent Yellow, Ontario, Gideon, Rideau, Haas, August, Walter, Wealthy, Mac Mahon. The seeds from these crosses were sown at Ottawa and gave 407 trees which began to bear fruit in 1910. Most of them produced fruit no bigger than that of the female parent, but 24 produced apples measuring more than 2 in. in diameter, especially the varieties:—

Wapella (Dean × Ontario) with fruit measuring 2.2 × 2.2 in.
Angus (Dean × Ontario) with fruit measuring 2.0 × 2.2 in.
Martin (Pioneer × Northern Spy) with fruit measuring 2.2 × 2.4 in.
Gretna (Pioneer × Northern Spy) with fruit measuring 2.0 × 2.2 in.

As has been seen previously cross pollination occurring naturally between apple trees growing side by side may produce superior strains. There would be a much greater probability of obtaining tangible and sure results were the hybridisation carried out artificially. This the author has already

done by using the varieties : — Anis, Anisim, Antonowka, Baldwin, Baxter, Bethel, Bingo, Cobalt, Crusoe, Duchess of Oldenbourg, Dyer, Danville-Famous, Forest, Glenton, Gravenstin, Hiberna, Lawyer, Lowland, Raspberry, Malinda, Milwaukee, Mac Intosh, Mac Mahon, Newton, Northern Spy, North Western Greening, R. I. Greening, Rosalie, Rouleau, Scott, Stone, Winter Rose; and Walton. At present there are about 1000 hybrids being cultivated, of which 100 have already borne fruit. Some of the best among the new varieties obtained in this way are Vermac (Lawyer ♀ × Mac Intosh ♂) and Rustler (Mac Intosh ♀ × Lawyer Mavis ♂).

1347 — Selection of the Valencia Orange in California, U. S. A. — SHAMEL, A. D., SCOTT, L. B. and POMEROY, C. S., in the *U. S. Department of Agriculture, Bulletin No. 624*, 120 pp. + 4 Tables + 9 Figs. + 14 Plates. Washington, July 25, 1918.

The Valencia orange, widely cultivated in California, has 10 stable characters, as was hitherto believed to be the case, but is composed of a large number of strains capable of being isolated and propagated. These strains differ from each other in the size and shape of the fruit, habit of growth, period of ripening, etc. There are twelve principal strains : —

1) *Valencia strain*. — Trees erect with open heads having large, rounded leaves ; irregular producers. Fruit globular, of medium size, slightly flattened at the blossom end; rind thin, bright orange in colour; juice abundant and sweet; 0 to 10 seeds per fruit with an average of 3. The fully ripened fruit is of good quality, inferior only to the Washington Navel variety.

2) *Corrugated strain*. — Trees with drooping branches and leaves smaller than those of the Valencia variety ; less productive than the Valencia. Fruit oblong or cylindrical; large, thick, very rough, corrugated rind, greenish; little juice of poor quality and flavour; an average of 2 or 3 seeds per fruit.

3) *Long strain*. — Trees similar to Valencia trees in habit of growth and foliage, but less productive. Fruit oval, and much longer than that of the other strains; cross diameter small to medium; rind smooth and of a bright orange colour; juice abundant, sweet and of good quality; an average of 1 or 2 seeds per fruit. The shape of the fruit makes it unsuitable for packing and marketing.

4) *Ribbed strain*. — Branches drooping very irregular production. Fruit globular, sometimes flattened at both ends, small, pale yellow ; rough rind with ribs running from one end to the other, giving the transversal section a polygonal shape; juice abundant but inferior in taste and quality to that of the Valencia strain; an average of 2 seeds per fruit. The shape of the rind detracts from the commercial character of the fruit.

5) *Yellow strain*. — Branches drooping ; annual production more regular than that of the ribbed strain. Fruit globular and small; rind thin, smooth and dark yellow in colour frequently with small red spots or streaks ; an average of 1 seed per fruit. On account of their smallness and colour these oranges are commercially inferior to Valencia ones but ripen about a month earlier, a fact which makes them valuable under certain soil and climatic conditions.

6) *Smooth strain*. — Upright trees producing fruit similar in shape to the Valencia strain, but smaller and much less abundant; the rind is very thin and very smooth (resembling the smooth strain of the Washing On Navel orange), reddish-orange in colour; juice abundant and sweet; an average of 2 or 3 seeds per fruit. Although much less productive than the Valencia orange this strain may prove valuable in California if it is isolated and improved by bud selection.

7) *Barren strain*. — The trees have a drooping habit of growth, are very finely branched and have dense foliage; they grow very vigorously and produce a very large number of flowers but little fruit. The fruit is small with a thick, rough rind and little juice; they are of inferior quality and unsuitable for commerce.

8) *Rough strain*. — Erect trees of vigorous growth tending to produce a large number of suckers and abnormal branches. Fruit inferior in quantity and quality to that of the Valencia strain, with thick, rough rind of an orange-yellow colour, comparatively little juice of medium quality.

9) *Sporting strain*. — The trees vary greatly in production and habit of growth and are extraordinarily vigorous; the leaves also vary greatly in size and shape and the foliage is rather dense. The fruit varies very much and includes all the forms of the Valencia orange as well as others. As a rule these trees produce a few fruits of the Valencia strain which, on the whole, are of little value commercially.

10) *Flat strain*. — Upright trees bearing very little medium-sized fruit flattened at both ends (which gives them a characteristic appearance), with a thick, rough, yellow-orange rind and little juice. They are of no value commercially.

11) *Navel strain*. — The trees resemble Valencia orange-trees in their yield and habits of growth; and their fruit is also similar in shape, size and colour but with a thinner and smoother rind and a small, often rudimentary, navel. This strain, which at times appears as a limb sport on Valencia trees, has been isolated and propagated commercially under the name of "Navelancia". It is of special interest because it is possible, by bud selection, to isolate from it a seedless strain of the Valencia variety.

12) *Willow-leaf strain*. — Drooping branches with leaves resembling those of the willow. Fruit is rarely produced and only in small quantities. It is very small with thick, rough, ridged and yellowish rind and little juice of inferior quality, making it quite useless commercially. It is one of the most interesting bud variations of the Valencia variety.

The eleven last strains are all derived from the Valencia variety (also known as Hart's Tardiff, Hart's Tardy and Hart's late) by bud variations which still occur in large numbers so that it is not unusual to find on one tree, or even on one branch, two or more of these strains. Many of them, as has been seen, are of inferior quality. In choosing bud wood sufficient attention has not been given to the variability of the Valencia variety so that many valueless variations have been widely propagated.

In view of these facts the authors attempted: — 1) to determine the degree of variability of the Valencia orange and the comparative commer-

cial value of the different strains; 2) to determine, by the proportion of inferior oranges in the plantations, to what extent undesirable variations have been propagated; 3) to control, by improved methods of propagation, the entrance of undesirable variations in commercial Valencia orange groves.

During the four years 1912-1915, 105 orange trees of the different strains described above were grown. For each strain annual determinations were made of: —

A) *The number and weight of the fruit of the 1st, 2nd and 3rd grade.* — The 1st, or Orchard, grade includes oranges perfect in shape and colour. The 2nd, or Standard, grade includes fruit which is saleable although faulty in colour, shape, etc. The fruit of these two classes is graded into sizes varying from 288 (the smallest) to 80 (the largest) by a mechanical sizer. The 3rd, or Cull, grade includes unsaleable, inferior quality fruit which are not sized, only their number and weight being recorded.

B) *Average number of seed per fruit*, determined by examining three fruits of each class, i. e., nine in all.

C) *Number of fruits deviating from the standard type.* — For example, in the Valencia strain all ribbed or other forms are considered deviations, and in the ribbed strain all Valencia or corrugated forms, etc. In the Sporting strain fruit of the Valencia type is considered normal.

The results, given in four tables, are as follows: —

**TOTAL FRUIT YIELD.** — On a general average this is between a maximum of 171.6 lb. for a high-yielding Valencia strain and a minimum of 6 lb. for the Barren strain in the following order: — Valencia 131.8 lb., Sporting 127.6 Corrugated 113.5, Long 107.2, Coarse 99.7, Rough 98.5, Low-yielding Valencia 91.1, Small yellow 79.1, Unproductive 77.2, Smooth 75.8, Yellow 72.1, Barren 6.0 lb.

**YIELD OF 1ST GRADE FRUIT.** — High-yielding Valencia 125.9 lb. per tree, Valencia 92.8, Sporting 80.7, Long 66.5, Low-yielding Valencia 61.6, Smooth 60.6, Coarse 53.1, Unproductive 50.0, Yellow 36.5, Small yellow 36.1, Rough 27.6, Corrugated 24.7, Barren 0.9 lb.

**PERCENTAGE OF VARIABLE FRUITS.** — This percentage includes a minimum of 3.4 for the high-yielding Valencia and a maximum of 50.3 for Barren with the following intermediate figures: — Valencia 3.4 %, Smooth 3.4, Low-yielding Valencia 3.8, Long 6.1, Coarse 6.3, Unproductive 7.2, Sporting 12.5, Small yellow 12.9, Yellow 30.6, Corrugated 34.5, Rough 47.3 %.

**CONCLUSIONS.** — The Valencia strain undeniably occupies the first place, it has only a slight tendency to vary (3.4 %) and produced much fruit, mostly 1st grade. It is the best orange from a commercial point of view. If selected the Smooth, Yellow, and Navel strains would prove valuable summer-ripening oranges. The other strains have no commercial value and should be gradually eliminated. By making observations similar to those described during a number of years and recording the results regularly it is possible to estimate definitely the value of an orange and thus to choose for propagation only those distinguished by low variability and a high yield of superior quality fruit. This system, though it does not exclude

completely the possibility of bud variations, makes it possible to obtain a high degree of uniformity and stability in the characters.

AGRICULTURAL  
SEEDS

1348 - Measures taken in Hungary for the Production of Sugar Beet Seed. — *Wochenschrift des Zentralvereines für die Rübenzucker-Industrie Oesterreichs und Ungarns*, Year LVI, No. 14, pp. 122-123. Vienna, April 4, 1918.

By an order dated March 21, 1918, regarding the production of sugar beet seed, the Hungarian Government has made some regulations based on the emergency war laws. The chief articles are given below.

*Article 1.* — Every sugar-beet grower who, in 1918, had undertaken, by a regular contract with a sugar works, to grow 25 hectares or more of sugar beets, is obliged to reserve  $\frac{1}{25}$  of that area for the growth of seedbearing sugar beets.

The *Sugar Beet Seed Commission* (see Art. 10) can allow fractions less than that fixed to be cultivated for seed and may in part or wholly exonerate growers from that obligation beyond a certain limit.

*Art. 2.* — The beet grower must obtain his seed-bearing plants from seed with which he will be specially provided by the sugar works and according to rules laid down by the Ministry of Agriculture.

*Art. 3.* — The beet grower must inform the sugar works as to the quantity of seed-bearers obtained during the first year, and if the works does not make other arrangements, he must keep the seed during the winter. The sugar works will then communicate the information received to the above-mentioned Commission.

*Art. 4.* — On request being made by the growers, the sugar works are required to allow them advances at the time of declaring the seed-bearers up to the value of these and when the beets have been delivered for extracting the sugar.

*Art. 5.* — In the case when the sugar works does not make different arrangements and even if the ordinary cultivation contract has not been renewed, the grower is obliged to replant the seed-bearing sugar beet the following season and give them the usual attention.

*Art. 6.* — If the grower does not replant the seed-bearing beets the sugar works is authorised, after duly informing the Commission, to confide the cultivation of the beets in question to other growers, paying the produce twice the maximum price fixed for ordinary beets if it is in autumn and  $2\frac{1}{2}$  times this price if it is in spring.

*Art. 7.* — The sugar works is obliged to take away from the grower, up till December 1, 1919, the seed he has produced, free at the consigning station, at a price equal to 18 times the maximum price, for that year's beets, that is, at a minimum of 250 kroner per 100 kg (11.37 per lb.) and according to the rules laid down by the Ministry of Agriculture.

*Art. 8.* — The seed-bearing beets obtained in conformity with the present order are considered to be requisitioned, in the sense that they cannot be disposed of in other ways, save by authorisation of the central Commission:

If the sugar works has been unable to obtain the seed it requires in



this way, it can, through the Commission, obtain it from other works having too much seed.

The grower may not retain the seed he requires, but must obtain it from the sugar works.

*Art. 9.* — Each sugar works must inform the central Commission as to the growers undertaking to grow sugar-beet seed, indicating the names, surnames, farms, districts, as well as the area cultivated for seed. This declaration must be made within the 15 days following the publication of the present order or within the 10 days after signing the contract.

*Art. 10.* — To apply this order, a *Sugar Beet Seed Commission* is constituted, including a President, nominated by the Minister of Agriculture, 4 ordinary members and 2 deputies, of which 2 members and 1 deputy must be proposed by agricultural organisations and 2 members and 1 deputy by the sugar works. The secretary of the Commission is the Director of the Plant Breeding Institute or his representative. The expenses of this Commission are paid by the Ministry of Agriculture.

*Art. 11.* — The order does not guarantee the validity of contracts existing between growers and sugar works, contracts which must be in conformity with the dispositions of the said order.

*Art. 12.* — Whosoever directly or indirectly in any way infringes the clauses of the order is liable to a minimum of 6 months in prison and 200 kroner fine. If it be shown that the defendant has even made a profit, he shall pay, over and above the fine, a sum equal to twice such profit. If the goods forming the subject of the infringement are found they will be confiscated:  $\frac{1}{5}$  will be paid to the informer and the remainder, after costs are deducted, will be paid to the Disabled Soldiers Fund.

These measures are to be applied by those responsible for the public peace.

1349 — Tests of Some Spring Wheats (Manitoba, Aurore and Marquis) in Vaucluse, France. — ZACHAREWICZ, in the *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 29, pp. 825-828. Paris, October 2, 1918.

CEREAL  
AND PULSE  
CROPS

In 1917 and 1918 the author continued his tests at Avignon of Manitoba wheat for autumn and spring sowing, so as to find out whether its resistance to winter cold would be maintained and thus corroborate the results already presented to the Academy of Agriculture at its meeting on July 25, 1917 (1), results that may be thus summed up: Manitoba wheat has shown its hardiness and its resistance to winter cold and may be therefore considered as much as an autumn as a spring wheat for the south of France.

As in the previous year, the trials were carried out in the experiment field of the "Ecole Normale d'Instituteurs d'Avignon", with the collaboration of M. GUÉRIN, Professor of Physical and Natural Science at that school. The seed was drilled on land turned in autumn without any manuring. The previous crop was potatoes on broken-up grass-land with the addition of cake and calcium superphosphate. The author delayed the autumn sowing until December 15, 1917 so as to see how sensitive the germ was to

(1) As regards the varieties Aurore and Marquis see R., June, 1918, Nos. 640 and 641. (2a.)

cold. Just after sowing the thermometer fell so low that germination only took place between January 8-15 and very irregularly. In spite of this delay the wheat did not suffer at all. It was even so vigorous that in April it was topped to avoid lodging which partly occurred on June 17 during heavy rain accompanied by wind. The amount of straw produced per acre increased to 5085 lb. per acre. The date of harvest compared with that of spring-sown Manitoba was only advanced 5 days.

The test of seed from two soils of different chemical composition only gave a slight difference in the yield.

Seed obtained from bearded ears gave yields distinctly higher than those from beardless ears (27.4 and 21.2 imp. bus. per acre respectively).

At the same time the author tested the varieties Kurrachee, of Indian origin, Aurore and Marquis.

The variety Kurrachee behaved very well. The stems were 31 in. high and gave square ears with black awns. The seed is red and elongated. This spring variety is hardy and seems worth propagating. The yield was 26.1 imp. bush. per acre.

The variety Aurore arrived too late and the yield was low on account of the drought (10.7 imp. bus. per acre). When sown in March it gave much more conclusive results in another experiment field. For the same reasons the Marquis variety yielded still less (6.9 imp. bus. per acre).

1350 - Cultural Tests with Sol II Wheat in South Sweden. — ÅKERMAN, Å., in the *Sveriges Utsädesförenings Tidskrift*, Year XXVIII, Pt. 3, pp. 121-124. Malmö, 1918. .

The Sol II variety of wheat, obtained from the cross Sol I  $\times$  Extra Squarehead II, is remarkable for the strength of its culms, its resistance to cold and early ripening which make it possible to sow (at the end of September) the seed which has just been gathered. The above cross was made in order to eliminate late ripening, the great defect of the Sol I variety. The seed of the same year, if sown immediately after harvest, germinate with difficulty, sometimes not at all, so that they have to be stored for some time to avoid these defects.

The new variety was tested in different localities in South Sweden, and the results obtained are given in the paper under review.

*Tornby Station* (near Linköping, Östergötland). — Below are given the average yields of the varieties tested for the period 1914-1917. The first figure shows the yield of grain in cwt. per acre, the second the relative index of productivity. Sol. I 31.37, 100; Sol II 33.72, 107.2; Bore 31.21, 97; Iduna 31.00, 99.1; Renodlad Squarehead 29.47, 94; Thule 1 30.22, 96.3; Thule II 31.61, 100.8.

*Svalöf Station* (Scania). — During the period 1916-1917 the Sol II variety gave good results but was inferior to the Pansar and Fylgia varieties. Sol. II 37.19, 105.1; Pansar 37.59, 112.5; Fylgia 36.47, 108.

*Ultana Station* (Uppland). — As the north is approached Sol II gradually loses its value; in cultural tests at Ultana it gave results much inferior to those of Thule wheat.

CONCLUSION. — Sol II is the type of wheat most suited to Östergöt-

land and the districts of Västergötland and the province of Bohus with similar weather conditions. Further south Sol II may be used wherever Fylgia wheat is not sufficiently resistant to the winter cold and where Pansar wheat is too late.

**1351 - Pansar Wheat in South Sweden.** — ÅKERMAN, Å., in the *Sveriges Utsädesförenings Tidsskrift*, Year XXVIII, Pt. 3, pp. 117-120. Malmö, 1918.

Of all the different varieties of wheat recently put on the market by the Swedish Seed-producing Society, the best is "Pansar" wheat, obtained by NILSSON-FHLE from the cross Kotte × Grenadier. Since 1915, when it was first put on the market, it has become gradually more and more popular on account of its high yield and good resistance to cold and rust. The winter of 1916-17 was a good test for resistance to cold; the Tystofte, Smaa, Vilhelmina, and even the Fylgia, varieties suffered more or less, whereas Pansar resisted and gave an excellent crop. This may be seen from the following comparative data; in each case the first figure represents cwt. per acre and the second the relative index of productivity as compared with that of native Swedish wheat ("Swenskt lantvete"), equal to 100: — Native Swedish wheat, 21.5, 100; Pansar 35.8, 167; Fylgia 31.8, 148; Tystofte Smaavede 26.0, 121; Sol II. 33.3 154; Sol I 31.1, 145; Extra Squarehead II 27.8, 129; Vilhelmina 13.0, 62. The low yield of the last variety is the result of its lack of resistance to cold.

The superiority of Pansar wheat is due, not only to its strength, but also to: — 1) its late ripening which enables it to benefit by the July rains; 2) the presence of a waxy covering on the leaves which regulates and modifies transpiration. These characters make Pansar wheat the variety best suited to Scania (provinces of Malmöhus and Kristianstad). It also gives good results in the provinces of Halland, South Kalmar, Blekinge, Öland, and Gotland.

**1352 - The Rational Distribution of the Different Varieties of Rye in Sweden.** — LUNGE W. E., in *Sveriges Utsädesförenings Tidsskrift*, Year XXVIII, Pt. 3, pp. 97-116. Malmö, 1918.

The comparative cultural experiments made at Svalöf and the branch stations since 1906 have shown which varieties of rye are best suited to the local weather and agio-geological conditions of the different provinces of Sweden. The most important results obtained are below: —

**SVALÖF 1907-1917.** — *Varieties tested:* — Stjärn and its line 0302, Schlanstedter and its line 0451, Frof. Heinrich and its line 0280, Petkuser, Probsteler and its line 0530, Bretagner and its line 0420, Wasa and selected Wasa, Midsschmar and its line 0590, native grey oats of Östgöta.

*Characters studied:* — Yield in grain and straw per acre, weight of a bushel of grain, weight of 1000 grains, strength of straw, shown by a number ranging from a minimum of 1 and a maximum of 10.

In all the tests taken together the Stjärn variety ranks first for yield with 34.4 cwt. of grain per acre and 55.4 cwt. of straw. In weight of grain (55 lb.) per bushel, resistance to cold and strength of straw (7.4), it is more

or less equal to Petkuser, the yield in grain of which is 6.9 % lower (32.25 cwt.). One of the few defects of Stiärn rye is the length of its culm which causes it to lodge easily. The author's attempts to isolate forms with short straw have already given good results. The stalks of line 0302 are from 2 to 3 inches shorter than those of the parent variety and also stronger (strength = 7.7 as compared with 7.4 for the original Stiärn).

Certain new lines (Nos. 0302, 0451, 0280, 0530, 0420) gave a yield in grain a little inferior to that of Petkuser. Line 0280 (of Prof. Heinrich) is remarkable for the strength of its straw (= 8). It is hoped to obtain good types of rye for central and northern Sweden from all these lines. The Danish variety Bretagner is inferior to the varieties Stiärn and Petkuser, with which it can compete in dry years only, in light, mellow land. None of the other varieties tested gave good results.

What has been said for Svalöf applies also to the provinces of Malmö and Kristianstad, as well as to those parts of the neighbouring provinces where the soil and weather conditions are similar.

**CENTRAL, SWEDEN.** — In the cultural tests made at the stations of Ultuna and Alnarp and the branch stations of Östergötland and Västergötland, the Stiärn variety, although followed closely by the lines 0302, 0451 and 0280, nevertheless took first place with 27.1 cwt. of grain per acre (compared with 25.7 cwt. for Petkuser). The native varieties Grey Rye of Östgöta, Ultuna, etc. were inferior in grain yield to Stiärn and Petkuser by 15 and 16 % respectively.

At Alnarp the Bretagner variety yielded a little more than Petkuser. This was the result of the great drought of 1916 which put to the proof its special resistance to drought.

**LOCAL CULTURAL TESTS:** — Tests were made in the provinces of Kristianstad, Östergötland, Stockholm, Upsala, Örebro, Göteborg, Bohus, Halland, Västmanland, Värmland, and in the Island of Gottland. In the first seven provinces the Stiärn variety ranked first and in the provinces of Västmanland and Halland better results were obtained with the Petkuser variety. In Värmland the Stiärn and Petkuser varieties were surpassed by selected Wasa rye and, in Halland, by the Bretagner variety. The native ryes (of Östgöta, Gottland, Göteborg, etc.) proved in every case inferior to the selected ones.

As the north and interior are approached the environmental conditions become less and less favourable to the Stiärn and Petkuser varieties which gradually lose their value and supremacy through their insufficient resistance to the severe winters, and are replaced by selected Wasa rye (e. g. in the province of Värmland). In the province of Stockholm and in Västerbotten common Wasa rye yields more than selected Wasa. In the cold districts of Norrbotten the local native types do best. This is shown by the following relative indices of productivity:

*In Västerbotten:* — Native Norrland rye 100, grey Östgöta rye 98.4, selected Wasa 110.2, common Wasa 123.4

*In Norrbotten:* — Selected Wasa 62.4, common Wasa 72, native Norrland rye 100.

2353 - Commercial Pulse Crops. — *Bulletin of the Imperial Institute*, Vol. XV, No. 4, pp. 503-544. London, October-December, 1917.

The chief leguminous plants that are cultivated chiefly for the sake of their seed in both tropical and temperate countries are: — *Arachis hypogaea* (Ground nut, earth nut, pea nut [U. S. A.], monkey nut, goober), *Cajanus indicus* (Pigeon pea or bean, Angola pea, Congo pea, Dál [India], Bombay tares), *Canavalia ensiformis* (Sword bean, over-look bean, cut-eye bean [W. Indies], horse beans [Montserrat], Go-ta-ni bean [E. Africa]), *Cicer arietinum* (Gram, Bengal gram, chick pea, Spanish pea, Garbanzo [Spain]), *Cyamopsis psoralioides* (Cluster bean, Guar bean [India]), *Dolichos biflorus* (Horse gram, Madras gram, Kulthi [India], *D. Lablab* (Indian bean, Lablab bean), *Ervum Lens* = *Lens esculenta* (Lentil), *Faba vulgaris* = *Vicia Faba* (Broad bean, Windsor bean, horse bean, field bean), *Glycine hispida* (Soy bean, soja bean), *Lathyrus sativus* (Chickling vetch, vetchling, grass pea, Indian pea, mutter or mattar pea, Khesari [India]), *Phaseolus aconitifolius* (Moth bean), *Ph. angularis* (Adzuki or Azuki bean [Japan]), *Ph. calcaratus* (Rice bean), *Ph. lunatus* (Lima or Duffin bean, Rangoon bean, Madagascar bean, butter bean), *Ph. Mungo* (Black gram, Urd [India]), *Ph. radiatus* (Green grain, Mung [India]), *Ph. vulgaris* (Dwarf bean, French bean, Kidney bean, haricot bean), *Pisum arvense* (Field pea, grey pea, dun pea, partridge pea, maple pea, blue pea, Bara mattar [India]), *Pisum sativum* (Common or garden pea), *Vigna Catjang* (Black-eye cow pea, cherry bean, cow pea, Chowlee, Lobia [India], Tow Cok [China]), *Voandzeia subterranea* (Bambarra ground nut, Mozambique gram, Madagascar earth nut). Although eaten as pulses in the countries where they are grown, ground nuts and soy beans are valued in Europe chiefly as oil seeds and they will therefore not be dealt with in this article.

*Canavalia ensiformis* (sword bean), *Cyamopsis psoralioides* (cluster or Guar bean) and *Voandzeia subterranea* (Bambarra ground nut) are of importance only in the countries where they are produced; they are, however, of value as food for man or for animals and a market for them may eventually be developed in Europe. Samples of "sword beans" from the Gold Coast, Honduras, Montserrat and Burma have been examined at the Imperial Institute, and no deleterious constituents were found in them, although they are considered to be harmful in some countries where they are grown, apparently on no very good grounds. Recently a variety of this species, called Go-ta-ni, has been received from British East Africa. Lablab beans are largely grown in China, India and other tropical countries. The Bambarra ground nut has also been examined at the Imperial Institute, and although no harmful constituents could be detected, it was not highly valued by merchants at that time (1909 and 1914). The great drawback to these pulses is that they are not known, and it is always difficult to find a market for them. The scarlet runner bean (*Phaseolus multiflorus*) is grown mainly for the sake of its green immature pods, but the ripe seeds are also eaten.

‡ The most important pulses commercially are the various kinds of peas and beans. The chief countries that export peas in normal times are India,

Russia, Japan, China and the Netherlands; those exporting beans are China, India, Turkey, Russia and Egypt. The trade of the United Kingdom in pulses is normally sharply divided into two sections:—1) for human food; 2) for cattle food. The first section includes:—haricot beans, white and coloured (*Phaseolus vulgaris*); Madagascar butter beans, Lima beans and Rangoon white beans (*Phaseolus lunatus*); green peas, smooth and wrinkled varieties (*Pisum sativum*); yellow peas, smooth and wrinkled (*Pisum sativum*); field peas (*P. arvense*) split or ground into meal or flour; chick peas or Spanish peas, white kinds (*Cicer arietinum*); lentils, whole or split (*Lens esculenta*); Japanese "Adzuki" or Chefoo red beans (*Phaseolus angularis*); other small beans produced by *Phaseolus* sp. The second section includes:—dun peas, maple peas, partridge peas, grey or field peas (*Pisum arvense*); broad beans and horse beans (*Vicia Faba*); pigeon peas or beans (*Cajanus indicus*); horse gram (*Dolichos biflorus*); Bengal gram or chick peas, coloured kinds (*Cicer arietinum*); all other kinds of coloured beans, including red Rangoon beans (*Phaseolus lunatus*). Various kinds of beans are known in British commerce as haricots, including the seeds of *Phaseolus vulgaris*, to which the term is more correctly applied, and the seeds of certain varieties of *P. lunatus*. Butter beans are furnished by other varieties of the same species.

*Phaseolus vulgaris*. — Before the war British supplies of true haricot beans were obtained chiefly from European countries especially Rumania, Germany, Belgium, Italy and France. These beans were chiefly white — "White Italian", "White Soissons", "White Danubian" — but coloured varieties "Rose Cosos" (speckled), "Canadian Wonder" (purple); "Burlotti" (speckled) were also imported. Since the war the Royal Horticultural Society has imported from Holland the "Dutch Brown" bean, of a light coffee-brown colour, and said to be superior in flavour to the white forms. In tropical South American countries beans form to a great extent the staple food of the people and are grown in large quantities. Before the war these countries had to import beans, but the last few years they have become exporters. Thus Brazil, in 1914 only exported 4441 kg., while, in 1915, 276159 kg., and, in the first 5 months of 1917, 53084'331 kg. were exported. Since the war Japan has also begun to export considerable amounts of haricot or kidney beans, that are either produced locally or imported from Manchuria, North China and Korea.

*Phaseolus lunatus*. — Originally native to South America, *P. lunatus* was introduced to Southern California as early as the fifteenth century, and is now widely cultivated throughout the warmer parts of the world. It was introduced into Madagascar about 1864, and since the French occupation it has become an important article of export. Madagascar traders wrongly call these beans cape peas or Pois du Cap, while on the London market they are called "butter" or Madagascar beans. In 1914, 8561 metric tons were exported, about 7 times more than in 1906 (1).

Forms of *Ph. lunatus* are largely grown in Burma. The two most com

(1) See R., March 1918, No. 291. (Ed.)

mon forms grown in Burma are the red-seeded and the white-seeded kinds, known commercially as "Burma red beans" and "Burma white" or "Rangoon" beans and locally as Pé-gya and Pè-byu-galè. In 1916-17 Burma exported 1 439 009 cwt. of pulse mostly to the United Kingdom. The Imperial Institute has sent to Burma samples of Madagascar butter beans for trial; the local Department of Agriculture are testing other white beans. The cultivated forms of *P. lunatus* from Madagascar, South America and Burma and probably also from the United States and Southern Europe rarely if ever yield hydrocyanic acid in quantities likely to be injurious. On the contrary that acid has been found in beans from wild plants in Java and Mauritius; for these reasons importations from new areas should be examined before being placed on the market.

In 1916 the United Kingdom imported 1 077 600 cwt. of haricot beans as against 313 063 cwt. in 1913. Since the war the imports of this bean are mostly from India (over  $\frac{7}{10}$  in 1917) followed by Madagascar and Japan.

*Small-seeded Phaseolus*. — The "azuki" bean (*P. angularis*) of China and Japan, "mung" (*P. radiatus*), "urd" (*P. Mungo*), "moth" (*P. acutifolius*) of India, and the "rice" bean (*P. calcaratus*) of India and the Far East are of great value as food-stuffs in the countries where they are grown, but are little known in Europe save as feeding-stuffs for cattle. *P. angularis* has been grown experimentally at the Arlington Farm, Virginia, U. S. A., with favourable results. Owing to its value for making flour or paste it should be tried wherever the haricot grows.

*Vicia Faba*. — The chief varieties grown in the United Kingdom are the following: — Heligoland bean; horse or tick bean; Scotch horse bean; winter field bean; early Mazagan bean; Long-pod bean; broad or "Windsor bean". The field bean is a common crop in Europe, and is largely grown for export in Egypt, Turkey and China. In 1916 the United Kingdom imported 1 110 605 cwt. of beans other than haricot beans. Before the war China, Germany and Turkey supplied a large proportion of the imports, but in 1915 more than half of the total import was obtained from British countries, British India and Egypt having increased their exports. A table gives the world's production of beans (area and crops) for 1910, 1911 and 1912; another gives that of peas.

Peas (*Pisum arvense* and *P. sativum*). — In 1916 the United Kingdom imported 981 331 cwt. of peas as against 2 464 607 cwt. in 1912. Before the war peas were chiefly supplied by India, New Zealand, Germany, Holland, Japan; since the war Japan and China have increased their contributions.

*Lathyrus sativus* (mutter peas.) — This is cultivated throughout India where it is known locally as Khesari. From Mediterranean countries the whiteflowered form has been introduced to Canada, where it is known as the "grass" pea, and is produced on a fairly large scale in Ontario. These peas have a high protein content but some forms are said to have poisonous properties which cause the disease known as lathyrism (paralysis of the lower extremities in man and animals) as a result of their continued use

as food. In India they are eaten by the poorer classes on account of their abundance and cheapness. The nature of the toxic substance causing lathyrism is not known. Seeds of forms obtained from India, Cyprus and Canada have been examined at the Imperial Institute with a view to the isolation of a toxic constituent, but with negative results. Investigations were conducted at the Agricultural Research Institute, Pusa, on samples obtained from Barail, a village near Pusa, which is notorious for cases of lathyrism, and the Central Provinces, where the disease also occurs, and it was found that samples of Khesari were often contaminated with seeds of *Vicia sativa* and *V. hirsuta*, from which a cyanogenetic glucoside was isolated. It is possible, therefore, that the harmful properties attributed to the seeds of *Lathyrus sativus* may in some cases be due to obnoxious impurities. Experiments conducted in Canada with Canadian grown *L. sativus* peas as food for fowls gave good results and no harmful effects were observed. It has been found that lathyrism only occurs in man when *L. sativus* peas form almost the sole diet. There is now much evidence in favour of the view that the use of any one kind of grain, even wheat, as the sole diet may lead to harmful results.

*Vigna Catjang* (Cow peas). — There are 2 varieties, the bushy (var. *typica*) and trailing (var. *sinensis*), both grown in most warm countries. For use as pulse the white or blotched forms are preferred; they are much eaten in Burma, and are appreciated in the United States and to a smaller extent in the United Kingdom.

*Lens esculenta* (Lentils). — Largely consumed as human food in Europe as well as in the East. In English commerce two forms are met with, "French" and "Egyptian"; the former are large, ashy-grey externally, yellow inside, and are usually sold entire; they come chiefly from Russia and Germany; the latter are small brown, with an orange-coloured inside and are usually sold "split"; they come chiefly from India. In 1915 the United Kingdom imported 329 870 cwt. and in 1916 143 960 cwt. of lentils.

*Cajanus indicus* (Pigeon pea). — Two forms are grown, and some authors have made them species. One form has yellow flowers (*C. flavus*) and usually only 2 unspotted seeds in each pod; the other (*C. bicolor*) has yellow flowers streaked with reddish purple and pods containing 4 or 5 seeds which are usually spotted or streaked. Experiments made at the Labour Farm, Bihar and Orissa, between 1908 and 1911, proved that the tall erect form (*bicolor*) was the superior and best suited to local conditions. It is cultivated in most tropical countries. In Bombay it is known as tur, tuer, togari, in Bengal as arhar or rahar; in Africa as the Congo pea, Congo bean or Angola pea; in the West Indies it is called no-eye pea, and in Mauritius and the Mascarene Islands it is known as ambrevade. It is also grown in Southern Rhodesia, Madagascar and Australia. The pigeon pea is largely used in India for human food, and as fodder for horses and other animals when the crop is plentiful.

*Cicer arietinum* (Gram or Chick pea). — It is grown in most parts of Southern Europe, particularly in Spain; in northern Africa, chiefly in Mo-



rocco ; in Asia, particularly in India, and in Mexico. About 500 000 acres are devoted to this crop in Spain, where the average production is estimated at 100 000 tons. In India the average area under grain for the 5 years 1909-10 to 1913-14 was about 15 million acres, with an average annual out-turn of about 3 million tons.

Experiments have recently been made at Pusa with a view to improving the types of chick peas grown in India, and 2 types have been selected, one producing a small whitish seed and the other a small reddish-brown seed. The former gave an average yield for 4 years of 1 600 lb. of seed per acre and the latter an average of 1 666 lb. for the same period.

The Indian chick peas are smaller than those of Europe, and are usually of a dark brown or reddish-brown colour ; they are chiefly used as food for cattle in the United Kingdom, but in India they constitute one of the staple foods of the people, being eaten either parched or boiled or ground into meal. Gram and barley roasted and ground into meal is known as "su too" and is sold in all Indian bazaars. Gram is much esteemed as a food for horses in the East ; it is, however, seldom given alone, but forms part of crushed foods. India furnishes most of the gram required in Europe ; in 1911-1912 India exported 6 934 840 cwt. and in 1916-17 761 930 cwt. of gram and forse-gram (*Dolichos biflorus*) ; the latter is grown chiefly in Southern India and shipped from Madras, the amount exported annually for the period 1911-12 to 1916-17 being 12 578 cwt.

*Composition and food value of pulses.* — The article concludes with a table showing the chemical composition of 21 pulses. If eaten in moderate quantities and properly prepared they are almost as digestible as other vegetable foods, but although pulses contain, weight for weight, as much protein as meat, they have not an equal food value as regards the nitrogen, since the proteins of meat are more readily absorbed than those of leguminous seeds.

1354 — *The Production of Tapioca in the Dutch East Indies.* — *Handelsberichten*, Year XII, No. 600, pp. 349-351. The Hague, 1918.

STARCH CROPS

The cultivation of manioc (*Manihot utilissima* Pohl), from whose starchy root tapioca is produced, has only recently been developed in the Dutch East Indies, although, already in 1854, official initiatives were taken. The aim of the Government was to provide the native with an "auxiliary food stuff" with the object of guarding against the lack of ordinary foods, especially rice, in times of famine. The population required several years in order to appreciate the utility of this crop, which now is fairly well diffused. The analysis of the manioc roots, made at the Laboratory of the Colonial Museum at Haarlem, gave the following results for fresh and dry samples respectively : — nitrogen, 0.26 and 0.50 % ; albuminoids, 1.63 and 3.30 % ; fats, 0.94 and 1.90 % ; carbohydrates (expressed as starch), 39.79 and 80.60 % ; crude fibre, 2.10 and 4.25 % ; ash, 0.24 and 0.48 %. The fresh sample contained 50.63 % of water.

The native population eats the roots as they are — skinned, then cooked or boiled — or mixed with other ingredients. The product for export is

prepared in works, now very common, especially in Java. In this way are obtained: — 1) manioc or cassava flour ("tapioca-meal"); 2) those products, prepared under another form and higher priced, called "tapioca perlé" and "tapioca flake". The dried manioc roots and the by-products obtained in preparing the flour are also exported. The exports are mostly towards the United Kingdom, the United States and the Netherlands. The number of metric tons exported from 1915 to 1917 are given below.

Products	Destination	1915	1916	1917
Manioc flour . . . . .	Netherlands . . . . .	7 279	79	227
	United Kingdom . . . . .	14 650	13 261	7 549
	France . . . . .	3 273	511	58
	United States . . . . .	13 344	37 655	31 473
	Penang . . . . .	38	639	1 475
	Singapore . . . . .	2 606	4 854	5 618
	Hong-Kong . . . . .	1 847	2 313	2 896
	China . . . . .	104	197	321
	Japan . . . . .	—	57	475
	Other countries . . . . .	706	55	206
Totals . . .		43 847	59 631	50 298
Manioc by-products . . .	All Countries . . . . .	2 612	913	103
Dried manioc roots . . .	" " . . . . .	31 546	8 378	1 522
Pearl tapioca . . . . .	" " . . . . .	459	1 186	4 812
Tapioca flake . . . . .	" " . . . . .	5 566	6 214	13 005

## FIBRE CROPS

1355 — The Possibility of Developing Cotton-growing in Cambodia. — DE FLACOURT, in *Congrès d'Agriculture coloniale*, Gouvernement général de l'Indochine, Saigon Series, Bulletin No. 5, 29 pp. Saigon, 1918. Review in the *Bulletin économique de l'Indochine*, Year XXI, No. 129, pp. 235-262. Hanoi-Haiphong, March-April, 1918.

Cotton is widely grown in Cambodia, along the banks of the Mékong and its chief tributaries, from Kratié to Banam, and along those of the Bassac, especially in the provinces of Saang (Residency of Kandal) and of Loenk-Dek and Prey Krabas (Residency of Takev). It is grown on a large scale and throughout the country it is grown sporadically round the huts, even in the most remote and difficult accessible districts.

VARIETIES. — Cambodia has four distinct varieties of cotton: —

1) "Krabas" or "Krabas bay" (*Gossypium hirsutum* L.) (1), of Ame-

(1) The Cambodian term "Krabas" (pronounced "Kreba" means raw unginned cotton, and has been extended to the cotton plant itself. This plant has hitherto been considered as a variety of *G. herbaceum* L. In this the duration of the vegetative life of the plant seems to have been taken into consideration far more than its actual characters. In Cambodia this cotton is annual, but it is the special cultural conditions to which it is subjected that make it so. Grown on banks flooded as soon as the waters fall, it naturally disappears when the waters, which cover all the flat country for 3 or 3 months, rise again. In the *Bulletin économique de l'Indochine* (p. 946, 1915) the author described it as a native type of the hirsute variety. (Author).

rican origin, usually known by the name of "Cambodian cotton". This is the only variety largely grown along the banks of the Mekong and the Bassac and their principal tributaries. It is the "Cambodian cotton" of India, where it was introduced some years ago and has been grown with good results.

2) "Krahan Tés" (*G. acuminatum* Roxbg.).

3) "Krabas Sàmrê" or "K. Sangkê", a type intermediate between *G. arboreum* L. and *G. indicum* Lamk. According to a determination verified by M. VIGUIER (Lecturer in Colonial Botany at the Sorbonne) it should be referred to *G. arboreum*.

4) "Krabas Sampau" (*G. arboreum*), found in 1915 in the Department of Siêm-rêap; it has not yet been definitely determined.

The last three types are only met with absolutely sporadically. They were introduced very long ago, probably from India, whereas the Cambodian *G. hirsutum* seems to have been introduced a relatively short while ago, doubtless directly from America. This last is the most important of the four types of Cambodian cotton, both with respect to the acreage over which it is grown and the large quantities of cotton it yields, giving rise to a brisk trade. In his report the author deals only with this *Cambodian type of hirsute cotton*.

The native crops are concentrated on the banks of the large river and principal watercourses (Chamcar) (1). They cover annually approximately 32 000 to 45 000 or 50 000 acres, according to the year, as the area cultivated varies with the height of the floods. As, in these soils cotton has to compete with other plants it is not possible to extend its cultivation much, the area of the banks being limited. Were it possible, by strong dikes, to protect from floods all the flat country behind the principal watercourses which form vast basins, the area over which cotton could be grown each year would be considerably increased. The best cotton lands in the State of Mississippi, U. S. A., were obtained by this method.

During the last six years the production of raw cotton in Cambodia was, in round figures:— 1912, 7 000 metric tons; 1913, 6 000; 1914, 8 000; 1915, 3 000; 1916, 5000; 1917, 5000. Most of the crop is ginned at the Khsach-Kandal works, and nearly all of it (except the 500 to 600 metric tons held back each year by the natives for sowing) is exported to Japan through Saigon, either directly or by way of Hongkong. The above figures show that the yield varies greatly from year to year. This is because, situated on the banks of the water-courses the native crops are cultivated at bad seasons. All the flat country is flooded by the Mekong (the floods of which are perfectly regular in duration) and it is impossible to choose the best time for sowing. The seed is sown as soon as the floods subside regularly and there is no more danger of their return. This occurs between the end of October and the beginning of December, and coincides with the end of the rainy season. Under these conditions the crops must depend large-

(1) The soil of the banks covered periodically by the floods are called "Chamcar" in Cambodian. (Author).

ly on chance. The relatively cold winter of Cambodia is early and if rain is more abundant than usual in March, April and May, the crop may be compromised.

These conditions also cause the fibre to be short (18 to 22 mm. at the most), irregular, woolly, and covered with small lumps caused by numerous completely atrophied seeds.

Attempts have been made to adapt cotton to soils sufficiently high to be completely free from floods. There is a considerable extent (19 768 000 to 247 110 000 acres) of such land in Cambodia. They are mostly low tablelands, slightly raised valleys or large plains. The experiments were started at the end of 1913 and, after four years, showed beyond doubt that the Cambodian cotton plant adapts itself very well to these lands and gives in them a better quality fibre (less woolly, more regular, without small lumps, on an average 24 to 29 mm. long), thus showing it is better suited to them.

Samples of cotton obtained from the first cultural experiments were sent to the Jardin colonial in August, 1915. These samples were examined by several experts, traders and manufacturers at Havre. The cotton was judged well suited to the French industry whereas, to use to the best advantage that obtained from "Chamcar" crops it would be necessary to modify or replace the machinery in French factories.

The author describes cultural tests made in red soil, soil of volcanic origin in layers of an average depth of 49 to 59 feet, purely vegetable, very permeable, but always cool, owing to the clay it contains. This soil covers an area estimated at 4 942 200 acres at an average altitude of at least 190 to 410 feet. During the experiments an average yield of 569 lb. of raw cotton per acre (without addition of fertiliser and without irrigation) giving 164 lb. on ginning was obtained. The yield of carded raw cotton was 34 %. The author estimates that the lands of Kompong-Cham and Kratié (1 482 600 acres), which offer a vast field for European and native colonisation will, when made fully productive, give an annual yield of more than 40 000 metric tons of carded cotton.

The improvement of the hirsute cotton of Cambodia by methodical selection is being undertaken by the local Agricultural Service, and, in spite of the difficulties due to present conditions, is almost accomplished. This, by multiplying the improved pure types, will make it possible to obtain a yet better yield of carded cotton.

One of the vital questions affecting the intensification of cotton production is that of the ginning industry and, to a lesser extent, that of the extraction of cottonseed oil. It is essential that the producer may be able to dispose of his crop, both immediately and progressively, at a remunerative price. The French cotton industry has too great an interest in this question not to give it full attention. The Association cotonnière coloniale especially has often interested itself in Cambodian cotton and is, therefore, in a position to do for Cambodia what it has done for West Africa, with a greater prospect of success.

The questions discussed above have attracted particularly the attention of the Chief of the Colony. No other crop is more suited to inclusion

in the economic programme of Indo-China than is cotton by reason of its rapid growth, great value of its product, and the ever-increasing necessity of freeing France from the onerous conditions of the foreign market.

1356 - The Deterioration of Egyptian Cottons and Means of Remedying it. — MOSSÉRI, V. M., in the *Bulletin de l'Union des Agriculteurs d'Egypte*, Year XVI No. 124, pp. 53-79. Cairo, August-September, 1908.

While it is incontestable that the qualities of the Egyptian cottons, especially those of the old varieties, have deteriorated of late years, opinion is very divided as to the causes of such deterioration. According to the theory most generally accepted at present, the Egyptian cottons are suffering from a degeneration which has considerably reduced their yield and hardness. Become more weakly, the cotton plants are more sensitive to bad weather and less resistant to the attacks of insects and other parasites. The very great spread of the pink bollworm (*Gelechia gossypiella*) appears to be owing to this degeneration.

As regards the pink bollworm, so far no type of cotton has been found that really has a natural or acquired immunity protecting it from the attacks of this insect, any more than from those of its other pests. The author hopes that this will be attained by selection. In fact, in India, the pink bollworm is a secondary pest; and, every time that Egyptian varieties have been introduced into that country, they have been literally ravaged while Indian cottons grown close by hardly suffered at all. It appears that Indian cottons have a certain natural immunity in this respect, probably of a histogenous nature, since MAXWELL-LEFROY attributes the resistance to a more abundant resinous gummy secretion in the valves of their capsules. This immunity is the result of a natural selection which may some time take place in the case of Egyptian cottons and thus protect them from this terrible pest.

But in the meanwhile, other means of control must not be neglected such as cultural, biological or technical methods the chief among which are the removal and subsequent burning of the capsules remaining after the last harvest, the collection of the capsules fallen on the ground and their burning, the treatment of the seeds so as to kill any larvae they contain, the growth of early varieties and the use of methods of cultivation so as to hasten, or to avoid the slightest retard in, maturity.

Experiments were carried out in 1916 and 1917 by the Minister of Agriculture in order to study the means of hastening maturity by the judicious use of pinching and removal of the leaves combined with a gradual reduction in the quantity of water supplied after the month of July. The results obtained along these lines seemed encouraging (1). It was found that the intensity of the attack of the pink bollworm does not in any way depend on the age of the Egyptian varieties, nor on their degree of purity or degeneration; if there is any degeneration.

The author denies any such degeneration and attempts to prove that

(1) *The Agricultural Journal of Egypt*, Vol. VII (1917), pp. 120-135. (Author)

the Egyptian cottons have undergone a *deterioration* of late years and not a degeneration in the strict sense of the term.

The *quantity* and *quality* were affected:— 1) in the quantity (yield) the deterioration showed under the effect of *accidental* causes; 2) in the quality, it was shown by *essential* causes.

The accidental causes are due to the environment and their effects come under the heading of "fluctuation" and are not permanent.

The essential causes are due to the constitution of the plant, i.e., to the way in which it reacts to the environmental conditions; their effects are permanent.

The author only deals with the *quality*. The essential causes are the most important and originate in the impurity of the type grown. The most efficient cause of this impurity lies in the natural or artificial crossings to which Egyptian cottons have been or are still the object. This hybridisation is chiefly due to growing several varieties side by side or to the use of seed containing a mixture of different types. The remedies are clear: isolate and purify the cultivated varieties or seek better ones, multiply them and propagate them without it being possible to contaminate them. Three methods have been suggested.

1) The first was begun by BALLS in the laboratory of the Khedival Agricultural Society, now the Sultanian Agricultural Society (1). It consists essentially in isolating a well determined type of pure strain, then, by crossing and methodical elimination, adding to the chosen type the advantageous specific characters that are required. This may be called the *addition* or *synthetic method*.

2) The second consists in annually isolating and selecting a certain number of plants showing the required specific characters. By repeated elimination of plants lacking the desirable characters the cases of atavism throw-back to an undesirable type are diminished more and more in the progeny. This may be called the *analytic* or *elimination method*.

3) The third method is that of the *selection* of advantageous variations.

The ideal solution of the durable and permanent improvement of Egyptian cottons can only be obtained by applying the remedies quoted above. There is no great difficulty in purifying the cultivated types, and the multiplication of pure seed is also fairly easy. But the propagation of such seeds free from the possibility of any future contamination constitutes the most delicate task for the moment. It is, however, an essential condition, as is shown by the excellent results obtained in the United States by the rigorous application of these principles. The author recalls the work done in this direction in the United States, especially in Arizona (2).

The author thinks that to resolve the problem, if not radically, at least as satisfactorily as possible, an organisation should be created under the aegis of the Government, a sort of *permanent Commission* in which all those interested in any way in the production of Egyptian cotton

(1) See R., August, 1915, p. 1017. (Ed.) — (2) See R., May, 1916, No. 518. (Ed.)

— producers, brokers, spinners, etc. — should be fully represented by their most competent elements. This organisation would take the question in hand, with the widest possible powers, and would follow a programme, the outline of which is given by the author as follows : —

1) Divide Egypt into zones of different climates ; create in each zone a chief station, with sub-stations should the type of soil require it, to undertake : —

a) the purification of the existing varieties or the creation of better ones by using one or another of the three methods given above, or, better still, simultaneously by all three methods ;

b) repeated tests to ascertain the varieties most suited to each zone;

c) the scientific study of the cotton plant ; in this it would probably be possible to collaborate with the powerful association (Cotton Research Association) now being formed in England to investigate scientifically in all the British Empire all the problems concerning the cotton industry.

2) Propagate the pure strains on land attached to these stations preparatory to multiplying them later on larger areas depending on, or rented by, the station, or cultivated by the owners under the direct control of representatives of the Permanent Commission.

3) Ginn the different types undergoing selection in machines belonging to the station.

4) Forbid the cultivation of several varieties side by side and only allow the cultivation in each zone of one of several varieties of those found the most remunerative, allotting one or more special works to each zone for ginning.

5) Inspect the fields to eliminate plants not true to type, etc.

6) Control and regulate the sale and distribution of the seed.

7) Forbid the propagation of a new variety until repeated cultivation tests in the stations controlled by the Commission have indisputably shown its superiority over the corresponding type already cultivated. These tests would be made on isolated areas so as to avoid any contamination.

Pessimistic conclusions should not be drawn from what has been so far said, for the future may be faced with confidence and for a long time still Egypt will occupy the first rank among countries producing fine, long staple cotton. Even now, in spite of the sensible decrease in its cotton production Egypt always holds a preponderating place. In fact, whilst America produces 100 000 bales of Sea-Island cotton and hardly 6000 bales of the Egyptian type of cotton. Egypt still furnishes more than a million.

Egypt could have profited by this supremacy had its cotton market been better organised. This would also be a task for the Permanent Commission the organisation of which is urged by the author.

1357 — **Four Large Scale Textile Crops : Jute, Crotalaria, Hibiscus, Sesbania, with a Note on Abroma.** — HAUTEFEUILLE, L., in the *Congress d'Agriculture Coloniale, Gouvernement général de l'Indochine*, Hanoi Series, No. 5, 65 pp. Hanoi-Haiphong, 1918.

The tests of textile plants carried out by the author on behalf of the Indo-Chinese Administration as the result of a mission to India in 1904 regard Tonkin and were spread over 8 or 9 years. They include ramie, jute,

the textile *crotalaria*, *Hibiscus cannabinus*, *Sesbania aculeata* and *Abroma augusta*. As ramie was worth dealing with separately (1) the other five plants are dealt with in the present study.

The utility of these tests is shown by the different conclusions to which they lead and which the author summarises as follows : — *Hibiscus cannabinus* seems unable to become suitably acclimatised to Tonkin; *Abroma augusta* will not grow healthily in dense plantations; *Sesbania aculeata* should do well in the alluvial, damp parts of the Tonkin delta; *Crotalaria juncea*, already tested at Hué and near Hanoi, is very hopeful and may prove a crop worth introducing into the country; jute, although finding in Indo-China less favourable conditions than those in British India may play, especially in Annam and Tonkin, on certain reduced points, an appreciable part.

1) JUTE. — This is the French and English name for two species of *Corchorus* — *C. capsularis* and *C. olitorius*. Jute is probably the most important textile fibre after cotton and hemp. According to WIGMAN (*Revue des cultures coloniales*, December, 1902) the annual production of British India amounted to about 1 476 300 tons and, at that time, Calcutta exported 100 million gunnies. Indo-China imports about 10 million such sacks which might well be made locally. All the jute, manufactured or not, comes from Bengal where the crop covers at least 24 700 000 acres. The idea of cultivating jute in Tonkin suggests itself naturally, as there is much analogy, generally speaking, between Bengal and that colony; the two deltas of the Ganges and Red River are mostly alluvial, abundantly provided with water; the climatic conditions are similar, labour is plentiful and easily satisfied. Ponds and watercourses are numerous in both countries, which is necessary for retting. The water communications help economically in the carriage of the bulky material. This material can be manufactured on the spot or exported through easily accessible ports. There are, however, sufficient differences between the two countries to call for caution; in particular, the distribution of the rainfall is less even in Tonkin than in Bengal.

The author considers in turn the species and varieties of jute (the two species only seem to include about 40 varieties, the species *capsularis* having 30 and the species *olitorius* 10), the requirements and peculiarities of its cultivation, the experiments carried out at La-Pho, the yields per acre, and the cultural and economic possibilities of jute in Indo-China.

The yields of well-dried fibre, obtained in the La-Pho experiments were : — 729, 923, 942, 892, 1 020, 1 030, 1 168, 1 236, and 1 275 lb. per acre. These yields are decidedly lower not only than those given by specialists, but also than those obtained at the Burdavan Experiment (Bengal) Farm, which reached as much as 2 641 lb. per acre. The highest yield obtained at the Phu-Thy Experiment Station was 1 445 lb per acre.

The highest monetary return obtained by the author (total return, not profit), was 61.75 \$ per *mau* (2) and the smallest return 50 \$, taking

(1) See No. 1358 of this *Review* (Ed.)

(2) The *piastre* (\$) is worth about 2 s. at *par*; the Annamite *mau* equals 38750 sq. ft. (Ed.)



jute at 12 \$ per 220 lb. At Phu-Thy 70 \$ per *man* was obtained. It may be said that the native gets a return of from 30 to 35 \$ from a *man* of land cultivated with jute. To obtain this, the expenses must not exceed those for maize or beans; the native and his family have simply to pay more attention to the crop. The choice of the moment for preparing the soil and sowing requires more care than for other crops. The operations of harvesting, cutting, retting and baling jute are more heavy than for any other crop. The author thinks this is the only consideration to take into account with the gross yield.

Although jute growing does not pay for European colonists, its growth by natives would only be possible when it is encouraged and supported for some years by the European colonists, who would act as bankers and exporters. In the future the help of the European colonists will probably be able to be dispensed with as the natives become more enterprising and less sedentary when, with them or by their help the intensive agricultural occupation of Central Tonkin will be undertaken.

II) CROTALARIA (*Crotalaria juncea*). — This papilionaceous legume is largely grown in British India for its fibre, which is treated locally and exported to Europe under the name of "Sunn hemp". Though inferior to jute it is very useful in mixtures. It is the only crotalaria cultivated out of the 30 species belonging to the Bengal flora. It is used for green manuring and its leaves and seeds are fed to live stock.

M. LEMARIÉ, at Heré, has been interested in this non-exhausting, but probably improving plant (owing to nitrogen-fixation by its root nodules), which is grown over such large areas in India that it may be inferred that the plant is not difficult and does well in varied soils and climates. He was aware that it can be harvested and defibrated more rapidly than jute and that it can more easily be introduced into crop rotations as it grows and flowers all through the year. According to the literature on the subject, a crotalaria requires less care than other crops.

The La-Pho experiments on *Crotalaria juncea* were not as ample as was necessary, but they have shown that it gives good and very regular yields in Tonkin; few crops are so easy and safe. Its growth and harvesting are always sure with the minimum of work: — ploughing once, harrowing once, no weeding, prompt retting, easy defibration, the possibility of harvesting after 75 days or leaving the crop standing without serious harm.

The financial return is low and the crop does not always find a ready sale. In fact 624 to 714 lb. of dry commercial fibre per acre, at 27s. 9d. per 220 lb. gives 58.3 s. and 90s. per acre or 35 to 40 \$ per *man*. But this is the maximum; the minimum yield of 446 lb. per acre or 25 \$ per *man* must be taken as a basis for calculation.

These are fairly good yields and would satisfy the native, considering the small amount of work sunn hemp requires; but they would not suffice for European colonists working directly. In order to encourage the natives to grow crotalaria, a fibre market should be established in Tonkin.

III) *Hibiscus cannabinus*. — From tests made at La-Pho and Bat-Bat

(Tonkin) it was found that *Hibiscus cannabinus* or Deccan hemp (1) or one of its varieties or varieties of *Hibiscus Sabdariffa* (or "Roselle hemp") may be of interest as a crop for Tonkin and, better still, Annam, in order to provide a fibre for local needs, especially in the mountain region. But it is not the moment to anticipate an important yield, not only on account of the cultural requirements of this Malvaceae, but especially because, in the Delta and Central regions, it does not fit in with the crop rotation:— if it is to follow a maize crop it cannot be harvested in time to follow it by rice.

• (V) *Sesbania aculeata*. — Leguminous plant also known as *Aeschynomene spinulosa*. This crop, which furnishes the "dunchi" of Bengal, may be grown in Tonkin in the future. It is a fibre for low, damp soil, and its growth, like that of *crotalaria*, is always sure in Tonkin with encouraging regularity; it has, moreover, the advantage of not being exhausting. But its fibre is inferior to that of jute and at present is only of interest for mixing with jute. The author thinks this fibre is not used alone industrially. *S. aculeata* gives fine crops in Tonkin and grows to a size there that helps it to resist passing floods.

V) *Abroma augusta*. — This Sterculiaceae plant produces a fine fibre, but does not enter easily into large-scale cultivation. It has to be grown suitably spaced, for as it branches greatly, it cannot be crowded, so as to obtain big and paying yields. In 1917, 3 plots of 300 sq. metres each, one 1 metre apart, the second 50 cm. apart, the third 35 cm. apart, gave respectively:—1) 95 kg. of green material = 3.56 kg. of well dried fibre, or 3.75 %; 2) 40 kg. of green material = 1.05 kg. of well dried fibre, or 2.64 %; 3) the third plot was very bad. Grown under suitable conditions *Abroma augusta* does not yield 178 lb. of fibre per acre.

So that the new trials might be justified, the price per kg. of the fibre would have to be 3 francs which, in spite of the beauty of the fibre, is not probable, unless some special use for it is discovered.

1358 — **Observations on Ramie in Indo-China.** — HAUTEFEUILLE L. in the *Congres d'Agriculture coloniale*, Gouvernement Général de l'Indochine, Hanoi Series, No. 4, pp. 51. Hanoi-Haiphong, 1918.

In his report to the Congress of Colonial Agriculture the author throws light on the ramie question as regards the exclusively cultural point of view. He has followed all that has been done on the subject of ramie for the last 40 years with the greatest attention. In this work he has collected and condensed all that has been published on the question in all the world as well as his own papers (especially in the *Bulletin économique de l'Indochine*, No. 115, September-October, 1915) containing data never before published and his personal observations. His work is, therefore, very complete and of decided importance for all those interested in the ramie question.

The author considers successively and in detail the requirements of ramie as regards soil, climate, manuring, depth of ploughing, permeability of the soil, effects of drought, sun and heat, irrigation, plantation, hoeing

(1) It is the "da" or "dah" of French West Africa. (Ed.)

and weeding, cutting, duration of a plantation, yield in fibre, presence and disadvantages of gum, treatment of the crop. He then describes experiments carried out at La-Pho (Tonkin). These experiments were insufficient but gave some results which are duly recorded.

**SPECIES AND VARIETIES.** — There are 4 ramies: — white ramie (*Boehmeria nivea*), green ramie (*B. utilis* or *Urtica tenacissima*) and two that have been found at Laos or Yunnan, one red, the other yellow. There are no striking differences in the general appearance in full growth of the various ramies, at least as regards the height. The observer must walk down the lands in order to see differences which regard mostly the number and thickness of the stems and the thriving appearance. The foliage of green and white ramie is always denser, with larger and darker leaves. The stems of yellow ramie are generally weaker than those of other ramies. As regards the number of stems the red and yellow were equal, while being inferior in this respect to the two others. This did not hold true at the beginning and end of summer. Winter has a depressing effect on all 4 ramies. The green species is persistent and the white is deciduous. This is very characteristic of white ramie, and less so of the red and yellow ones. But green ramie, if it is not deciduous, grows so poorly that it cannot be utilised for at least three months. It long survives the hot season and dominates the others in October and November, but, in January and February, it completely ceases growth, only recommencing when white ramie begins again (March-April), almost regaining the lost time. At the end of the season green ramie wins and only begins to weaken in November, while white ramie begins in July.

Green ramie visibly suffers during the winter, whilst the white, though stopping growth in winter, retains its initial vigour; but the growth of the latter stops as soon as the heat becomes intense and continuous. Moreover it suffers visibly from sudden heat waves. These observations were made during the 2nd and 3rd year and the author adds those made in the 4th and 5th (last) of the plantation: — green ramie gradually fades from year to year, as does the white though less clearly if still visibly owing to the effect of the great heat.

**INFLUENCE OF THE SOIL.** — This is considerable. Valleys of secondary watercourses could probably be found with the rich and permeable soils that suit ramie; very few such soils are free from the danger of floods and cold.

**GROWTH AND SPACING.** — Growth was rapid, but limited, quickly stopped. The stems attained their full length in 6 or 7 weeks, afterwards making little progress. No stems were obtained more than 63 in. long, save in the La-Pho garden and in a specially treated field, where some as long as 86 in. were obtained. The plants were 20 in. apart in the rows and 28 in. apart between the rows, an insufficient density.

**Hoeing and Weeding.** — Ramie must always be kept very clean, which is expensive. Summer weedings should be no less than 4 and to keep it as clean as is really necessary, the number should be 8. The author reckons that the upkeep alone of the plantation costs 20 *piastres* per *muu*.

PERCENTAGE OF FIBRE. — From 44 lb. of green material weighed the day when cut (after 24 hours the weight has already decreased by 10 %), percentages of fibre were obtained varying from 2.78 to 3.38. Each year, the first cut, gives a higher percentage.

YIELD AND COST PRICE. — The author has estimated a yield of 1220 lb. of 'hemp' per hectare for 3 cuts in the year, or 475 lb. per *mau*. Considering that it might be sold at 600 francs per metric ton or 129.60 fr. per *mau*, i. e., 52 *piastres*, the expenses (hoeing and weeding, cutting, defibration, drying of fibre, baling, depreciation in 10 years of plantation) come to 50 *piastres*.

RAMIE IN INDO-CHINA (CONCLUSIONS). — As has been said, 4 varieties were under consideration : — white ramie, green ramie and the two yellow and red varieties ; of these the first two seem of most interest. Although the observations made are insufficient to allow a final classing, they justify the apprehensions felt by the author during the trials regarding this crop about which all has to be yet learnt. It appears that green ramie (*Boehmeria utilis*) would not give the regular and abundant crops reported from other warm countries. Green ramie is persistent and seems to be the variety most suited to very hot climates with no winter. It suffers in Bengal, where it falls short of its reputation, as the author found with Mr. PRAIN, at the Calcutta Botanical Garden, and with Anglo-Indian planters. White ramie, on the contrary, seems to be the variety for temperate climates. It does well in France in Vaucluse, Limoges, even at Gennevilliers, as is known, but it does not resist the trying summers in Tonkin.

Yellow and red ramie are acclimatised in Tonkin. Yet they grow less vigorously than the white ; they run no risk there, but their stems are less fine.

It is only a question of appearances, noted not only at La-Pho, but also on private estates. Several years of observations are required in order to find by what modifications of the classical cultural methods the yield of those rames already acclimatised may be improved or the influence of the climate attenuated for the exotic, white and green rames. But there is another question, apart from the purely cultural stand point, that relates to the production of ramie — to find a rational cultural method so as to obtain, with the minimum expense, good quality ramie fibre, utilisable commercially, in paying quantities, from plantations of sufficient duration.

The chief of the La-Pho station was aware that the really rational cultural conditions for ramie were unknown. All remains to be learnt and discovered, for no plantation in the world has been continued successfully, giving lessons, examples, or, if it exists, it has not been revealed in such a way that it can be considered as a living enterprise for cropping ramie fibre. The amateurs, for conceit, inventors and business men for self-interest, have not always made known what they have learned or have often asserted that of which they were ignorant, when they have not deceived the public.

The observations made at La-Pho in 10 fields, i. e., on 10 different sites, over an area of 2 *maus* have shown that the choice of sites suitable

for ramie is very limited, so much so that it may be foreseen that large areas will not be occupied by this crop as yet in Tonkin. In fact, clay soils, with abundant moisture, are unsuitable for ramie, as are highlands whether they are hard, stony or sandy. Ramie can be grown neither on slopes, nor on narrow terraces that dry up in a few days, or on impermeable terraces.

Alluvial, rich, deep soils, theoretically so suitable, are, for several months of the year (those when growth is at its maximum and when the ramie should produce), soaked like a sponge. A plantation can only be started if water can be removed or given, by drainage and irrigation, at the required time. It is, therefore, if one wishes to grow it on a large scale, a crop for an engineer and a clever, resourceful engineer. Besides, all these soils are threatened by the great floods, which are fatal to ramie.

So much for the large-scale cultivation of ramie and it is worth while to add that ramie can be grown almost everywhere, round the house in tiny plots of soil, raised near the houses, cultivated like gardens, with soil brought to the spot, as it is grown on high land by the mountain dwellers who might produce much more were they guided and encouraged by better prices.

The studies and practical tests made by the author have resulted in these observations, which state the problem much more clearly than before. The result is not very encouraging and only enables the author to indicate the difficulties to be overcome, the illusions to be avoided and a programme of researches to be carried out.

Ramie has been discussed too much in scientific literature and business circles for the Indo-Chinese administration not to have attempted to ascertain whether, as has been asserted with confidence, Tonkin is suited to the crop.

1359 - **Agave Cultivation in Tropical and Intertropical Countries Especially Madagascar.** — HOFFMANN, A., in the *Revue Agricole et Vétérinaire de Madagascar et Dépendances*, Year III, No. 19, pp. 219-226. Tananarive, 1918.

Of late years agave cultivation has continuously extended in nearly all tropical and intertropical countries. In order to encourage the growth of this crop in Madagascar the author publishes the following general information as to this textile plant and its production.

The agave is indigenous to Mexico, South America and the southern part of North America. The first plants were imported into Europe and India about the middle of the sixteenth century but Europeans only began to take an interest in this crop towards the end of the nineteenth century. The following species are known : —

*Agave americana*, the maguey of Mexico, growing wild in temperate zones, with a very fine, white fibre ; its sap is used in treating skin diseases. *A. decipiens*, or false sisal, of no cultural interest. *A. mexicana*, imported into Madagascar, where its growth is not advisable on account of the strong, lateral spines. *A. vivipara*, one of the few varieties suitable, for damp soils, mostly grown in India. *A. Lespinassei* or "Zapupe" (VINCENT), one of the best varieties for yield and hardiness. *A. rigida* var. *elongata*, indigenous

to Mexico, prefers a warm, dry climate and very dry, stony, calcareous soils; rarely grows above an altitude of 1000 ft. One sisal plant yields 16 to 40 leaves a year; the fibre content varies from 3.5 to 4.2 %, according to the soil; besides extracting the fibre, attempts have been made to extract alcohol from the pulp (residue of the decorticated leaves).

Although very hardy, agaves have certain requirements: light volcanic soils, dry and rich in lime suit them best; too damp or clayey soils should be avoided. Shade and torrential rains are very harmful. In short, they require a tropical climate, well drained soils and a distinctly dry season.

As regards the nursery and the preparation of the soil the author gives the following advice: —

If the soil is not rich enough, some manure mixed with wood ashes should be turned under. The earth should be banked up well round each plant and the soil must be kept free from weeds; when, after 12 or 16 months, the plants are 14 to 16 in. high, they can be transplanted. The methods of preparing the soil and planting obviously vary according to the district; the soil should be well cleaned and tilled, and if too poor in lime, it should be limed. The distance between the plants varies according to the districts and is controlled by the desire to plant as many plants as possible per hectare; the author advises  $78 \times 98$  in. or  $78 \times 118$  in. which gives 1650 or 2000 plants per hectare; After transplanting, before or towards the end of the rainy season the attention required consists in replacing dead plants, cleaning or weeding, removing the suckers that live at the expense of the parent plant (these suckers, dried in the sun serve, with the bulbils, for reproduction).

The harvest takes place 3 years after transplanting. Mature leaves can be recognised by their yellowish-green colour and the silver-grey colour of the terminal spine; at the first cut each plant can give 25 to 35 leaves.

The author next gives details regarding transport to the works and the works itself that may be required near a plantation. He gives a scheme for a plantation, with running expenses for Madagascar, and arrives at a total of 200 000 francs (including the works and not counting administrative expenses) for a 200 hectare plantation in Madagascar. Under these conditions the cost price per hectare ready to be exploited comes up to about 1000 francs. If the yield is calculated, it will be seen that the products of the first two years will pay all the cost of plantation. In countries where labour is still relatively cheap and the value of land moderate (as in Madagascar) a profit of 500 to 600 francs per hectare per year may be counted on.

In conclusion the author remarks that the agave is one of the few plants that suffer little from insects and fungi; even locusts rarely attack it.

important. The plants that produce these essential oils in the Dutch East Indies are wild or cultivated.

Among the wild species may be mentioned the "cajuput" (1) from which is obtained cajaput oil by distilling the leaves. Adulteration with paraffin, benzine, etc., is all the more common as it is not easily detected; adulteration may, however, be detected by violently shaking a bottle half-filled with the oil; the air bubbles produced vanish at once in the pure liquid, remaining, however, for some time in the adulterated product. The green colour of the oil is due to the presence of copper and chlorophyll compounds; this is why a small piece of copper is often added to the product. Cajaput oil is much used in therapeutics. It is mostly exported to Singapore, the chief market of the product for British India. It is also sent to the United States where it is used in making a number of proprietary pharmaceutical products. Good quantities are also bought by Siam, Hong-Kong and Timor Island; in Europe, the chief buyers are Great Britain, Holland and Germany. In 1913, 1914 and 1915 the total exports were 124 228, 65 469 and 79 863 kg. At present there is a tendency for eucalyptus oil to replace this product.

The species cultivated occupy an area of about 3 000 hectares, 2 700 of which are in Java alone. They are often found with other crops on large estates. The chief essential oils furnished by these species are given below:—

*Citronella oil* is obtained by distilling "serchwangi-grass" (1) a grass mostly cultivated by the natives; 1 000 kg. of the grass yield about 7 kg. of the oil, which is mostly used in soap and perfume making (synthetic essence of roses). The chief producing countries are Ceylon and Java; Java produces by far the smaller quantity, but the product is of better quality and fetches twice the price of the other. The exportation of Javanese citronella oil to all countries was:—1913, 75 230 kg.; 1914, 136 654 kg.; 1915, 233 326 kg.; 1916, 428 743 kg.; 1917, 515 763 kg. The largest importers are the United Kingdom, the United States and Japan.

*Lemon-grass oil*.—Produced from the grass of the same name (1), the yield being 0.2 %. At present importers prefer the oil from Cochin-China and Reunion.

*Cananga oil*.—Obtained by distilling the fresh flowers of the cananga (1), a tree that usually flowers twice a year, giving 60 kg. of flowers; to obtain 1 kg. of oil requires at least 350 kg. of flowers. This product is only exported in small quantities and it is not specially mentioned in official statistics; it has to compete with ylang-ylang oil from the Philippines, which costs 10 times as much (2).

(1) The cajuput is *Melaleuca leucodendron* L. "Serchwangigrass", giving citronella oil, is *Andropogon Nardus*. Lemon grass is *A. Nardus* var. *flexuosus* Haek. Cananga is *Cananga odorata* (see Note 2). The two Magnolias giving champaca oil are *Michelia Champaca* L. and *M. longifolia*. Vitivert or cuscus grass is *Andropogon muricatus* Rets. (Ed.).

(2) Ylang-ylang oil consists of the first fractions obtained in distilling the flowers of *Cananga odorata*; cananga oil is the whole product from distilling these flowers. (Ed.).

*Champaca* oil is obtained by distilling the flowers of two *Magnolia*-ceae (1) common in India and which flower throughout the year; the oil-yield of the flowers is about 0.2 %.

*Vetiver* oil is obtained from the roots of the vetiver or cuscus grass (1); the roots contain from 0.4 to 0.9% of essential oil; no official statistics as to its exportation are available.

*Patchouly* oil is obtained by distilling the stems and leaves of *Pogostemon Patchouly* Pell. The leaves can be gathered repeatedly, at intervals of 6 months. The east coast of Sumatra furnishes most of the supply; so far it is not specially mentioned in the official statistics.

*Geranium* oil is obtained by distilling the leaves of *Pelargonium* spp., the essential oil of which much resembles that of the rose. It is widely cultivated, especially in rubber plantations. During some researches it was found that 71 plants gave 76.5 kg. of leaves, which produces 53 cc. of essential oil containing as much as 58.8 % of geraniol.

1361 — *The Cultivation of Pyrethrum in Switzerland.* — FAES, H., in the *Schweizerische Apotheker-Zeitung*, Vol. XVI, p. 429, 1918, reproduced by HARLAY in the *Journal de Pharmacie et de Chimie*, Series 7, Vol. XVIII, No. 7, pp. 213-215. Paris, 1918.

The pyrethrum from whose flowers the insect powder is obtained is the *Pyrethrum cinerariaefolium* of Montenegro, Dalmatia, Herzegovina and Istria, which grows up to an altitude of 3250 ft., and *P. roseum* and *P. carneum* of the Caucasus and Northern Persia, which grow up to 6500 ft. Since 1912 the author has grown *P. cinerariaefolium* in Switzerland and it has quickly spread. At the end of 1917, 97 plantations were established, with a total of 24890 plants. The dried flowers are now worth 11d. per lb. and the seeds 36s. 8d.

Sowing is done in April to May or in July to August with freshly-gathered seeds, in lines 8 in. apart; a mulch of leaves or fresh manure should be given, followed by watering and tilling. After 2 or 3 weeks the plants are already vigorous and they must be transplanted into warm, gravelly soil at a distance of 20 × 24 in.

The plantation begins to yield well after the second year. Flowering takes place in May. The flowers are all gathered in June, when most of them begin to open, and they are spread out in a shed in the shade to dry. The yield of dried flowers is 28 to 29 % of the fresh flowers. Flowers to be used for seed-production for extending the plantations are left on the plant until they have completely expanded (about July 15).

Experiments have shown that Swiss pyrethrum powder is quite comparable, as regards quality, to that from Dalmatia and Montenegro.

1362 — *The Production and Price of Orchil.* — *In-en Utvoer*, Year III, No. 40, p. 897. Amsterdam, 1918.

Orchil, a dye extracted from various lichens (2), is used for imparting olive-green and brown shades to feathers, etc., especially ostrich feathers.

(1) See note on previous page.

(2) These lichens belong to the genus *Roccella* (*R. tinctoria* D. C.; *R. phycopsis* Ach; *R. fuciformis* D. C.), There are a number of substitutes for orchil, especially synthetic azo-compounds. (Ed.)



It is extracted chiefly in the United Kingdom, the lichens being imported from the Cape Verde islands. Of late years the United Kingdom has exported the following amounts to the United States. — 1914, 229 068 lb.; 1915, 372 803 lb.; 1916, 512 607 lb.; 1917, 209 383 lb. The increased exportation of orchil up to 1916 is due to the decrease in that of the German dyes; the increased in price to 6 ½ d. per lb. in 1917 against 3.7d. in 1914 is equally significant.

1363 — **The Production of Divi-divi in The Dominican Republic.** — MC LEAN, A., in *Commerce Reports*, No. 120, p. 708, Washington D. C., 1918.

Divi-divi is the commercial name for the astringent pods of *Caesalpinia coriaria* Willd. a leguminous shrub indigenous to the Dominican Republic. The plant is between 20 and 30 ft. high and bears white flowers; the fruit is a bean, about 2 in length, 1 in. in width, and about ¼ inch in thickness; it contains about 30 % of a tannic acid used in the manufacture of leather. The bean ripens and falls to the ground from November to April; if it rains while the beans are on the ground they are ruined and large quantities are lost in this manner, as November and December are rainy months in this Republic.

Whole families of the poorer people devote their entire time to gathering divi-divi beans and bringing them to market. It is difficult to state the average yield per shrub; some produce as many as 70 lb. or more, and others of the same age yield only half that quantity. Almost all of the divi-divi shrubs in the Puerto Plata consular district are to be found in the arid lands on the Province of Monte Cristi. They are not cultivated, but grow wild over vast sections of the Province. The town of Monte Cristi, on the north coast near the Haitian border, is the centre of the industry and is the port from which most of it is exported. Divi-divi is usually packed for export in jute sacks weighing from 110 to 125 lb. gross. It was formerly shipped to some extent in bulk in sailing vessels, but this mode of shipment has been discontinued, as it was not found practicable. The value of this product is determined by its quality and appearance; large, plump and ruddy beans are in good demand, while small black and broken beans are unsalable.

The annual exports of divi-divi from Monte Cristi formerly exceeded 2 000 000 lb. but of late years they have fallen below these figures. This decline in the output is attributed to a species of orchid, which lives on the shrubs. This parasite reduces the production and often kills the plant. Nothing has been done to eliminate this pest, although it has spread at an alarming rate, so that there is hardly a shrub which is not infested with it.

Prior to the war divi-divi was exported to Hamburg almost exclusively. The past few years, however, it has found a ready market in New York. The prices were formerly fixed in Hamburg at from 9 to 12 marks per 50 kilos (from \$ 0.0195 to \$ 0.026 per lb.), but now it brings from \$ 50 to \$ 55 a ton of 2 000 lb. f. o. b. New York.

RUBBER,  
GUM AND RESIN  
CROPS

- 1364 - Comparative Results of the Growth of *Hevea*, *Castilloa* and *Funtumia* Rubber Trees at Tobago. — VERTEUIL, J. de (Superintendent of Field Experiments), in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, Pt. 1, pp. 50-51 + 1 Table. Trinidad, 1918.

In 1907 five experiment plots were planted with alternate rows of *Hevea*, *Castilloa* and *Funtumia*. When the trees were four years old (in 1911) the different plots were subjected to the following treatments: — 1) manure; 2) ammonium sulphate and potassium sulphate fertiliser; 3) indigo as cover crop; 4) mulched with grass; 5) control.

As a result of the shade from the rubber trees it was impossible to grow the cover crop in 1914, and in 1915, manuring and mulching were no longer carried out regularly. The circumference of the trees was measured in 1911, before the plots were treated, and then regularly each year till December 1916. The results obtained for each species respectively in each plot are given in a table and lead to the following conclusions: —

The *Castilloa* grew most rapidly and the *Funtumia* most slowly. After manuring the annual growth of *Hevea* was superior to that of *Castilloa* and best in the plot with a cover crop. The *Castilloa* did best in the plot fertilised with ammonium sulphate and potassium sulphate, and the *Funtumia* in the control plot.

In short, *Funtumia* derived no benefit from the treatment of the plots, *Castilloa* no apparent benefit and *Hevea* a slight benefit. It should be noted that the soil of the various plots, of excellent quality, was far from exhausted by crops at the time the experiments were undertaken.

## FORESTRY

- 1365 - Effect of Grazing upon Western Yellow-Pine Reproduction in the National Forests of Arizona and New Mexico, U. S. A. — HILL, R. R. (Grazing Examiner), in U. S. Dept. of Agriculture, Bulletin No. 580, *Contribution from The Forest Service, Professional Paper*, pp. 27 + 2 Figs. + 3 Plates. Washington, D. C., 1917.

The present bulletin gives the results of a study undertaken to determine the character and extent of the damage to young growth of western yellow pine in the southwestern United States due to the grazing of live stock, and to find out the best means of keeping such damage at a minimum while permitting proper utilisation of the range.

Of 8 945 trees of a size subject to grazing, observed over a 3-year period, 1 493 or 16.7 %, were severely damaged each year and 1 442, or 16.1 % were moderately damaged. The most injured are the seedlings, 21 % of which are seriously damaged. The damage gradually decreases with an increase in the size of the trees. Trees above 4.5 feet in height are free from severe injuries from browsing, but those between 3 and 6 feet in height are likely to be rubbed severely.

The greatest amount of damage occurs during the latter half of June and the first part of July, or when the effects of the spring dry period are most pronounced. The least damage occurs during the first few weeks of the growing period, or before June 15. A very considerable amount of damage is done during the main growing season and during the autumn drying period.

Under normal conditions of grazing, cattle and horses, and inci-

dentally burros, do an inconsiderable amount of damage to reproduction. Sheep under the same conditions may be responsible for severe injury to 11 % of the total stand. On overgrazed areas all classes of stock are apt, however, to damage small trees severely. Cattle and horses may damage about 10 % of all reproduction. When sheep are grazed along with them, however, at least 35 % of the total stand may be severely damaged. Ordinarily sheep cause about seven and a half times as much damage as cattle.

The density of forage does not affect the amount of damage that may be caused on a given area. The suitability of the forage to the class of stock using a range has also an important influence upon the amount of damage to timber reproduction. Because of the suitability of the pure bunchgrass type to sheep grazing, the reproduction over approximately  $\frac{1}{3}$  of the bunchgrass type on one National Forest is being seriously injured. The amount of palatable feed available during the grazing season, and especially during June and July, has also an important bearing upon the amount of damage that grazing will cause to reproduction. During a favourable year the damage may be 18 % less than during a subnormal year.

The manner in which stock is handled has much to do with the severity of grazing damage. Cattle are likely to injure 22 % of the trees between 3 and 6 feet in height that grow on areas where they are accustomed to congregate. Sheep severely injure reproduction along driveways and on bed grounds.

Grazing is believed to have a largely neutral effect upon the germination and early establishment of reproduction, but to have an important effect in reducing the destruction of reproduction by fire. The effect of grazing upon the height growth of reproduction is marked. Severely injured trees grow only from  $\frac{1}{2}$  to  $\frac{1}{3}$  as fast as uninjured trees. Grazing injuries are not responsible for the common deformities of mature trees.

It appears that the permanent effects of grazing injuries upon the development of damaged trees are not serious, provided they have a chance to recuperate. If grazing is unrestricted, about 15 % of the total stand is likely to be killed during the period required for reproduction to become established. Reproduction that has been impoverished greatly by grazing is more likely to be attacked by fungi and insects than uninjured and vigorous reproduction. However, the ordinary grazing injuries are not believed to increase seriously the danger of such attacks.

**1366 - National Parks in Spain.**—*Boletín de la Real Sociedad Geográfica, Revista de Geografía colonial y mercantil*, Vol. XV, Nos. 8-10, pp. 376-377. Madrid, August-October, 1918.

By the royal decree dated August 16, 1918, was founded in Spain, besides the National Park of "la Montaña de Covadonga" or "Peña Santa" in the Asturian-leonais Picos de Europa (1), the National Park of "Valle de Ordesa" or "río Ara", in the Arragonese Pyrenees.

(1) See also R., June 1917, No. 556. (Ed.)

## LIVE STOCK AND BREEDING.

## HYGIENE

1367 - On Ocular and Locomotor Troubles in Equine Trypanosomiasis, in Morocco. — VÉLU, H. (Research Laboratory of the "Service de l'Élevage"), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 506-568. Paris, 1918.

The author considers ocular and locomotor troubles and their respective importance in equine trypanosomiasis, in Morocco (1).

*Ocular troubles* (yellowish conjunctiva, sometimes congestion of the conjunctiva, oedematous eyelids, often true conjunctivitis as well) are fairly constant, but they are not important as locomotor troubles. Nevertheless, ocular troubles can become much more serious in grave cases of rapid course: the eyelids are swollen, the eyes completely closed, there are tears of blood, and even keratitis is sometimes observed. The author quotes one of these serious cases which he had examined closely.

*Locomotor troubles* are, together with stupefaction, among the most constant symptoms, although they vary according to the animal and the intensity of the attack. They may be shown by slight difficulty in walking, unsteady trotting, as well as by being more evident, even showing paraplegia and an incomplete coordination of movement which may lead to loss of balance. Very evident locomotor troubles are, in addition, accompanied by incontinence of urine.

1368 - On the Mortality from Trypanosomiasis of Dromedaries. — SERGENT, EDMOND and ÉTIENNE, FOLY, H. and LHERITIER, A. (Institut Pasteur d'Algérie), in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 568-570. Paris, 1918.

The observations described by the authors are those on the first cases of trypanosomiasis of the dromedary ("debab") which could be controlled by laboratory methods during the whole of their duration. In 2 cases of natural infection the animals died after 4 months; in one case of infection by inoculation the animal seemed to have recovered in 18 months. The authors have also considered the part played by over-driving and by intercurrent diseases in the death of infected dromedaries and they have found that trypanosomiasis of the dromedary decreases its resistance to fatigue and privations (action of cold, fasting, heavy rain, etc.) and renders it much more sensible to other infections, which is a character very similar to malaria.

The authors state that amongst Algerian livestock, 10 % of the animals are usually infected with trypanosomiasis.

1369 - Endoglobular Parasites of the Horse in Morocco. — VÉLU, H., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 1, pp. 26-27. Paris, January 9, 1918.

Work carried out in the research laboratory of the "Service de l'Élevage" in Morocco.

\*In Morocco there are two equine piroplasmoses:—

1) true piroplasmosis, due to *Piroplasma caballi*, with haemoglobinuria, paresis, and sometimes paraplegia; 2) equine nuttalliosis due to *Nut-*

(1) See also R., June 1917, No. 562. (Ed.)

*tallia equi*, of which the author has seen but one case, which ended fatally. In this case there was very strong jaundice and haemoglobinuria; three-fourths of the erythrocytes were parasitised at the moment of death and more than half of them contained two or more parasites.

1370 — **The Etiological Cause and Treatment of Granular Dermatitis of the Horse.** — VAN SAGEGHEM, R., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 575-578. Paris, 1918.

Some recent experiments of the author confirm his own previous observation that flies transmit the larvae of *Habronema*, the etiological cause of "summer sores". The author has further observed that the parasite found in the nodules of "summer sores" is a wandering larva of *Habronema muscae*. Larvae of *Musca domestica*, bred in the laboratory were placed in fresh manure from a horse known to be parasitised by *Habronema muscae*. The flies bred out from these larvae were found to be infested by *Habronema* larvae at the rate of 70 %; the fly can only be infected during its larval stage. Observations on the *Habronema* larvae isolated from the flies enable the author to state that when placed on the dry skin or on the hair the larvae could neither move about nor pierce the skin, and so died quickly, and that they could only fix themselves at breaks in the continuity of the skin or on lubricated mucosa. Direct infestation by manure is thus very uncertain. The treatment may be prophylactic and curative.

**PROPHYLACTIC TREATMENT.** — This consists in fighting against *Habronema*, which lives in enormous numbers in the stomach of the horse. To destroy the adult form, administer arsenic at the rate of 1 to 2 gm. per day; to destroy the larval form, abolish the permanent litter and bury the fresh manure each day in the fermenting manure heap; the *Habronema* larvae, like those of flies, are killed by the heat developed in the manure; this is the biothermic method proposed by ROUBAUD (*Comptes Rendus Acad. des Sciences*, 1915, p. 325). It is obvious that combating the flies helps in fighting against the spread of summer sores, which must be specially protected in the hot weather by dusting the sores with some drying powder.

**CURATIVE TREATMENT.** — The author has obtained the best results by disinfecting the sore, then applying a power composed of 100 parts of gypsum, 20 of alum, 10 of naphthaline, and 10 of quinine. The sores soon heal up if the plaster is kept renewed as long as there is any break in the skin.

In an additional note M. ROUBAUD says that the *biothermic method* suggested by him ought to be more widely used in veterinary hygiene, for the heat produced by fermenting horse manure can also be used for destroying the eggs and larvae of other parasites of the horse — oxyurus, ascarids, strongylids, etc. — present in the manure.

1371 — **The First Tests of Vaccination against Epizootic Lymphangitis.** — BOQUET, A., NÈGRE, L., and ROIG, G., in the *Bulletin de la Société de Pathologie Exotique*, Vol. XI, No. 7, pp. 551-553. Paris, 1918.

By means of cultures of RIVOLTA's parasite, obtained recently, the authors have been able to carry out tests of preventive vaccination against epizootic lymphangitis (1), which previously was impossible as the crypto-

(1) See R, Sept. 1918, No. 1003. (Ed.)

coccus had not been cultivated in series. The method is based on the fact, discovered by the authors, that the serum of animals affected for more than 15 days, or cured, is rich in antibodies and that the natural or experimental disease confers immunity. The colonies of cryptococci, two months old, are ground in a dry state, emulsified in physiological salt solution, then placed in capsules which are heated at 62-64° C. for one hour. Four hypodermic injections of 5 cc. are given in the neck at intervals of 8 days.

The authors describe, as an example, an experiment made on 4 healthy horses treated by this method. The injections caused a slight oedema at the point of injection, followed, after its disappearance, by a slight hardening, but causing no open abscess. Eight days after the last injection, 2 horses were given, as a test, a hypodermic injection of 4 cc. of living cultures of cryptococci emulsified in physiological salt solution. The results were as follows:—the two vaccinated horses not inoculated with living cultures showed no symptom whatever of lymphangitis after 3 months; nor did the other 2 horses. The authors conclude that the vaccinated horses seem to have been immunised by the injection of heated cultures against the inoculation of living cultures of RIVOLTA's cryptococcus. They further add that the 4 horses vaccinated lived in the closest contact with gravely infected animals, and that these results show the possibility of vaccinating horses against epizootic lymphangitis by inoculation of sterilised cultures.

1372 — **Distomatosis and Glycosuria in Cattle, in Brazil.** — PARREVIA HORTA, P., in *A Lavoura*, Year XXII, Nos. 3 and 4, pp. 157-158. Rio de Janeiro, 1918.

In the course of his work on rabies the author found, some years ago, while doing post mortem examinations on cattle, the presence of a helminthid often completely blocking the bile ducts and which was a large distomum now known as *Eurithrema pancreaticum*. Since then, when carrying out post mortems the author has always looked for this distomum and he states that there are few occasions when he has not found the parasite. Recently he also observed it in large numbers in the pancreas of a calf, thus showing that it can abundantly infest a young animal.

Seeing that these parasites are found in large quantities in the liver of animals suffering from glycosuria, the author suggests a relation of cause and effect between the two facts and throws doubt on the value of glycosuria as a diagnostic index of rabies, an index usually considered as quite sure.

1373 — **The Presence of the Virus of Rabies in the Spleen.** — REMLINGER, P., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 8, pp. 406-412 + 4 Tables. Paris, 1918.

In a series of inoculations of the spleen of a guinea-pig that had died from rabies into other guinea-pigs, the author found that the virus of rabies occurs much more often in the spleen than is generally admitted. The presence of the virus in that organ is completely independant from any post-mortem generalisation (1), as putrefaction is rather a hindrance to the diffusion of the virus of rabies in the spleen.

(1) See R. Oct., 1918, No. 1127. (Ed.)

1374 — **The Control of the Blow-Fly and the Sheep Maggot Fly in Queensland** (1). — *Queensland Agricultural Journal*, Vol. IX, No. 4, pp. 136-137. Brisbane, April, 1918.

I. — **BLOW-FLY TRAP.** — Mr. H. A. Adams, of Vallerói, Queensland, has made a cheap trap for blow flies (*Calliphora* sp.) with a petrol tin. The tin is cut near the square upper end, on three of the vertical sides, then the upper part thus cut is bent over on the vertical side left intact; in this way an upper and a lower compartment are formed. In the lower half decomposed sheeps' entrails are put as a bait and in the upper half a sweetened arsenical solution. Two strips of flannel, about 2 in wide are arranged so that they reach the bottom of the liquid and rest on the bait which is thus kept well poisoned. The bait must be well decomposed before using or the arsenic will prevent it from decomposing.

II. — **CONTROL OF THE SHEEP MAGGOT FLY** (*Lucilia sericata*). — The author (L. G. JONES) thinks that the dags where the fly usually lays her eggs, should be left on the sheep, instead of cutting them as is often done; the dags should be poisoned by submerging them in a very strong arsenical solution. The solution is prepared by heating  $\frac{1}{2}$  lb. of washing soda in 4 gallons of rain water nearly to boiling point and then adding 1 lb. of commercial arsenic; it is then brought quickly to the boil, continuing for 15 minutes. As soon as the mixture is lifted off the fire, 4 pints of cold water are added and stirred well in, as after arsenic has been boiled in water it goes more completely into solution when suddenly put off the boil. The author is of the opinion that there is no advantage in using poisoned offal baits. It has even a contrary effect for, after a short time the fly leaves its natural medium — carcasses — and attacks the sheep. On the other hand the poisoned dags repel the flies, to the advantage of the sheep. In addition the sheep should have an arsenical sheep lick (4 parts of salt + 1 part of a mixture of  $\frac{3}{4}$  of iron ore and  $\frac{1}{4}$  of mispickel). All the arsenic would not be absorbed by the organism, and a part would pass out with the droppings, which would then be in such a condition as to retard greatly the development of the maggots. If the fly lays eggs on any part of the sheep's body other than the tail, it is because the yolk is diseased (damp, sticky and often badly smelling), the sheep being in bad health. In this case iron is a very appropriate medicine for sheep (2).

1375 — **On a New Disease of the Dog in Senegal.** — HECKENROTH, F., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 8, pp. 399-403. Paris, August, 1918.

The author records the appearance in Senegal of a special, and possibly new, disease of the dog. It is chiefly shown by nervous disorder ending

(1) See R., 1914, No. 1017; R., 1915, Nos. 401 and 1051; R., 1916, No. 1295. (Ed.)

(2) Reduce to a fine powder and mix 1 part of ironstone (containing chiefly a mixture of ferrous and ferric oxides) with 4 parts of mispickel; mix the whole with salt at the rate of 1 to 4 and give the stock free access to it in their troughs. This provides a good remedy against intestinal and blood parasites as well as an excellent tonic. The author made this discovery by noting that, in certain pastures of New South Wales the sheep themselves seek for the tickholes where the ironstone occurs. Pastures where ironstone occurs are among the most paying (L. G. JONES, a Natural Remedy for Worms and Blood Diseases in Stock, in the *Queensland Agricultural Journal*, Vol. IX, No. 2, pp. 48-51. Brisbane, February, 1918.

in death and, in some points, resembles rabies, of which the author suggests it may be an atypical case.

The symptoms observed and the results of the laboratory researches, directed especially towards the diagnosis of rabies, are described. NEGRI corpuscles in the horns of Ammon were sought for in four dogs but with negative results.

1376 - Description of a Bacterium which Oxidises Arsenites and of Another which Reduces Arsenates, Isolated from a Cattle-Dipping Tank in South Africa. — GREEN, H., in *The South African Journal of Science*, Vol. XIV, No. 11, pp. 465-467. The Cape, June, 1908

A number of arsenic-resistant organisms have been isolated from a cattle-dipping tank. These include: —

1) *An oxidising organism*, changing arsenites to arsenates, causing deterioration of arsenical dips, and which seems to be the only one to which rapid oxidation of arsenites is to be ascribed. It has been provisionally named *Bacterium arsenoxydans*; its dimensions are variable (length 1 to 3  $\mu$ ; breadth 0.3 to 0.6  $\mu$ ). It is easily differentiated from other organisms by its high tolerance to arsenite, the limit of tolerance being about 1 %. Under suitable conditions the rate of oxidation increases as the concentration of arsenite decreases.

2) *A reducing organism* which under normal conditions rapidly reduces arsenates to arsenites. This organism has been named *Bacterium arsenreducens* and appears to belong to the colon-typhoid family, from the other members of which it can easily be differentiated by its high resistance to arsenites. It is polymorphic, motile and of very variable dimensions (length 1 to 6  $\mu$ ; breadth 0.3 to 0.6  $\mu$ ).

Other arsenic-resistant organisms have been isolated from the dipping tank. They neither reduce arsenate nor oxidise arsenite. Amongst these are members of the *putridum* group one of which, *B. fluorescens non-liquefaciens*, can grow freely in concentrations up to 1 %  $\text{As}_2\text{O}_3$  as arsenite.

1377 - Elimination of Arsenic after Ingestion by, and Injection into, Live Stock, and After Absorption through the Skin by Dipping. — GREEN, H. II., in *The South African Journal of Science*, Vol. XIV, No. 11, pp. 472-473, The Cape, June, 1908.

Numerous experiments have been carried out to show the distribution of arsenic in the stomach and intestinal tract at various intervals after dosing and on its rate of elimination in the urine and faeces. The distribution of arsenic in the different compartments of the stomach of the sheep depends upon the path taken in swallowing. If the animal takes material voluntarily, as in the form of a lick, the greater proportion passes into the rumen, and thence slowly through the abomasum into the intestine. If the animal is forcibly dosed, a considerable part of the arsenic may pass direct to the abomasum, from which it is more rapidly passed on into the intestine.

Rate of absorption and elimination of soluble arsenic is rapid, and the path of elimination of either arsenite or arsenate of sodium is chiefly by the kidneys, about  $\frac{4}{5}$  of the dose appearing in the urine, and only  $\frac{1}{5}$ , or less, in the faeces. After ingestion 25 % of the dose may be eliminated in the



urine within 24 hours, and as much as 60 % within 48 hours; later, the urine only contains traces. In the faeces the maximum output usually occurs in the third day, and by the seventh or eighth day the solid excreta are practically arsenic-free.

When soluble arsenite is injected straight into the blood stream the path of elimination is almost wholly through the urine. Elimination begins almost at once, and several per cent of the injected amount may appear within half an hour.

The data for horses and cattle are more limited. With the horse, however, the absorption of soluble arsenic appears to be less complete, and a large proportion is eliminated in the faeces. The amount of arsenic eliminated by cattle and horses after dipping in arsenical tanks is very small, and the currently accepted data are shown to be erroneous. Currently accepted data for arsenic retained in the skin of dipped animals are also shown to be too high.

**1378 - Researches on the Utilisation of Inosite by the Animal Organism.** — I. ANDERSON, R. J., Influence of Inosite on the Respiratory Quotient in the Dog, in the *New York Agricultural Experiment Station Technical Bulletin*, No 54, pp. 3-9 + 4 Tables — II. ANDERSON, R. J and BOSWORTH, A W, Influence of Inosite on the Metabolism of Man, *Ibid*, pp. 10-16 + 6 Tables. Geneva, N. Y., 1916

FEEDS  
AND  
FEEDING

I. — Inosite, discovered by SCHERER in muscle, has since been found in many animal and plant tissues. The author reviews the chief work done on the utilisation of inosite by the animal organism (KÜLZ, MAYER, STARKENSTEIN), which shows that a very small quantity of the inosite ingested is eliminated by the kidneys. In order to obtain further data on the subject, the author observed the influence of the ingestion of inosite on the respiratory quotient of the dog. The dog was fed with meat once a day together with 2 gm. of inosite per kg. live weight and was then at once placed in a respiration chamber. Under these conditions no noteworthy changes were observed in the respiratory quotient. In addition it was found that inosite is neither stored up nor oxidised, the greater part (about 77 %) being excreted unchanged mostly in the faeces and a small part in the urine.

II. — Results of observations relating to the influence of inosite on the metabolism of man. One of the authors took 10 gm. of inosite 3 times a day. It first acted as a purgative but, after a few days, the stools become normal. Here again, no sensible effect of the ingestion of inosite on the metabolism of man was observed, if it is not a greater excretion of creatinin which became manifest as soon as the subject ceased to take inosite daily. It was also found that, in man, a very small amount (9 %) of the inosite ingested is eliminated in the urine, while the faeces contain none at all. The authors have not yet been able to ascertain how the remaining 91 % is utilised in the organism.

**1379 - The Dietary Qualities of Barley.** — STEENBOCK, H., KENT, H. E. and GROSS, E. G. (Laboratory of Agricultural Chemistry, University of Wisconsin), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 61-74 + 20 Diagrams. Baltimore, July, 1918.

The authors studied the dietary qualities of barley with the help of

investigations similar to those used since the work of HOPKINS, OSBORNE and MENDEL, FUNK, and MCCOLLUM, which have already been applied to various foods (1). Rats were used in the experiments. The food (barley in this case) was first ground to a coarse meal, dried for two hours at 70 to 80°C. and ground to a fine meal to which were added the usual supplements, casein, butter, fat, mineral salts, etc.

CONCLUSIONS. — Barley alone cannot satisfy the requirements of a growing animal, or even allow any noteworthy amount of growth. The addition of the fat-soluble vitamine (given as butter fat) remedies this defect to a certain extent, whereas casein has little effect. The addition of mineral salts gives better results. When all these supplements are added growth is normal. Barley contains the water-soluble vitamine in abundance, but neither sufficient fat-soluble vitamine nor sufficient protein (only 13.6%). Both of these, as well as mineral salts, must, therefore, be added to a ration consisting exclusively of barley, to allow normal growth.

1380 — **The Cleaning and Crushing of Locust Beans and the Removal of their Kernels.**

— GOURN, R., in the *Journal d'Agriculture pratique*, Year LXXXII, No 20, pp 388-389. Paris, October 3, 1918

The author points out that accidents often happen to animals fed on locust beans as a result of the formation of plugs in the digestive tract. For this reason the French Military Administration, when it introduced locust beans into the rations of army horses, ordered that the beans must first be cleaned, crushed and freed from their kernels, only 1 % being allowed to be left in. The food thus prepared was called "caroubine". During 18 months the author was in charge of the supervision and reception of this foodstuff which was sent to all the dépôts of the 15th District. Throughout this period no mishap was reported.

To test the possibility of introducing locust beans into the diet M. FOURCADE, Chemist of the Commissariat Laboratory, made a chemical analysis of them which gave the following results:— moisture 11.79 %; ash, 4.90; fat, 1.90; nitrogen, 23.62; starch, traces. This absence of starch in a seed is notable. There is no doubt that the kernel contains a special substance which causes the formation of plugs and may even have a paralyzing action on the peristaltic movements of the oesophagus. The irregularity of the effects leads to the supposition that this substance occurs in more or less large quantities according to the state of preservation, origin and variety of the locust bean. Grafted trees give pods much richer in saccharose and without the bitter taste of those from seedlings.

The author and M. ANDOUARD have had no opportunity of observing accidents to cattle through eating locust beans. These may be due to digestion by rumination. It is probable that, mastication being less complete (owing to the sharp, woody parts), cases of suffocation are rather more frequent than in horses. The cleaning and crushing of locust beans, and even the removal of the kernels, are advised, the expenses incurred being amply compensated for by the security obtained.

(1) See R. Jan., Feb., March, April, May, June, July, 1918, Nos. 2, 62, 186, 316, 377, 547, 659, 662 and 782. (Ed.)

1381 - Value of Bulbs as a Cattle Food; Investigations in the Netherlands. — EZENDAM, J. A., in *Verslagen van den Landbouwkundige Onderzoekingen der Rykslandbouw-proefstations*, No. XXII, pp. 176-185 + 5 Tables + 13 Figs. The Hague, 1918.

Among the many vegetable products which have been used recently as cattle food there are many which, although their utilisation for such purpose is not new, have rarely been specially examined from the point of view of their food value. This is the case of bulbs, grown over 12 355 acres in the Netherlands in 1913. Under present conditions it was, therefore, natural to attempt to use these bulbs as cattle food, and to study their food value. The Royal Agricultural Station for the Control of Cattle Food at Wageningen made experiments on this subject. The following analytical results were obtained for bulbs of narcissi, tulips, hyacinths, gladioli and crocuses respectively: — Albumen 2.5, 3.8, 2.4, 3.0, 5.2 %; fat, 0.3, 0.2, 0.1, 0.2, 0.3 %; starch 29.6, 34.2, 24.3, 25.4, 42.2 %; crude fibre, 1.8, 1.6, 1.0, 1.4, 2.5 %; moisture, 64.5, 59.2, 71.2, 68.7, 48.9 %; ash, 1.3, 1.0, 1.0, 1.3, 1.1 %. These figures show the bulbs to be comparable to potatoes, the average dry matter content of which is, however, only 25 %, whereas that of the bulbs is much higher, almost double in the case of the crocus. Supposing the digestibility of the starch of these bulbs to be 90 % as in the potato, the starch value on a dry matter basis would be: — narcissus bulbs 27.0, tulip bulbs 31.0, hyacinth bulbs 21.9, gladiolus bulbs 23.8, crocus bulbs 38.8. KELLNER placed the starch value of the potato at 19, so that, according to these data, the maximum price of the bulbs should be 1.42, 1.6, 1.15, 1.25 and 2.0 times that of the potato for the narcissus, tulip, hyacinth, gladiolus and crocus respectively. The food value of these bulbs, therefore, differs widely and is dependent especially on their dry matter content. The scientific literature gives little information on their practical use and most of the investigations on the subject are old. FROHNER (*Lehrbuch der Toxicologie für Tierärzten*, p. 156, 1890) says that *Narcissus pseudo-narcissus* and *N. poeticus* cause poisoning by an alkaloid, narcitine. As such poisoning has been observed in cattle, pigs and goats the unsuitability of narcissus bulbs as a food may be considered definitely established. There is also doubt as to the effects of hyacinth bulbs though when boiled they may be safely fed to stock. The same may be said of tulip bulbs which should be boiled several times renewing the water each time. Crocus bulbs which, according to KOBERT, contain saponin, may be fed to young pigs if small quantities are given at first and increased gradually; pigs may even be fattened by this process. There is little data on gladiolus bulbs, but the author has been unable to trace any record of evil effects following their use.

In times of shortage the use of these bulbs as a cattle food is worthy of attention if the above mentioned precautions are taken. As these precautions vary with the different kinds of bulb it is necessary to be able to recognise to what variety the bulbs belong or, if the food is composed of a mixture of bulbs, the material used must be known. To facilitate this the author gives for each species of bulb short indications on the shape and size of the starch grains, the position of the hilum, etc. Micro-photographs are also given.

## BREEDING

1382 - Crosses Between the American Bison, the European Bison and Domestic Cow Made in the Zoological Garden of Askania-Nova (Government of Tauride, South Russia) (1). — IVANOV, F. and PHILIPTSCHENKO Jur. (Zootechnical Station of the Veterinary Service of Askania-Nova), in the *Zeitschrift für induktive Abstammungs- und Vererbungslehre*, Vol. 16, Pt. 1-2, pp. 1-18 + Figs. Leipzig, 1916.

During the summer of 1913, the authors studied the crosses made by M. F. E. FALZ-FEIN between the American bison (*Bison americanus*), European bison (*Bison bonasus*) and the domestic cow in his zoological garden at Askania-Nova; there were then 25, the most typical of which were described, with figures and measurements.

CROSSES BETWEEN AMERICAN BISON AND EUROPEAN BISON. — According to the authors such crosses have not been previously made save at Askania-Nova. There were adult hybrids (2 5-year old males and one 4-year old female, "Sanka"), produced from a male European bison and a female American bison. In 1911, the female "Sanka" was mounted by a European bison, and produced a heifer calf in 1912. Next crossed with a American bison × European bison hybrid, she gave, in 1913, a bull calf; this represents the  $F_2$  generation of the cross between American and European bison. The progeny of the female "Sanka" are still too young to be used in the research.

The American × European bison hybrids have, as regards their exterior a form intermediate between that of their parents. The head, as regards the hair and fringe on the throat resembles that of the American bison rather than that of the European one. The hump is smaller than in the American bison and its sweep to the head is less stiff and is more similar to the European bison. The resemblance of the animals to the European bison holds good also for the hind-quarters. The tail is of intermediate development. On the contrary the colour is like that of the European bison. As regards size and development the hybrids equal or surpass their parents. If their characters remain constant in future generations (which is not yet certain), the authors think these forms would have to be considered as a new species, which they propose to call *Bison falzfeini*, in honour of the breeder.

CROSSES BETWEEN AMERICAN BISON AND DOMESTIC COW. — On crossing a male American bison with a domestic cow, 2 males (now aged 14 and 13 years) were produced in the first generation as well as 2 females (13 and 11 years). As the 2 males ("Mischka" and "Selifon") were sterile they were castrated. The females ("Staraja" and "Podpalaja"), however, were fertile and on crossing either with American bison or domestic bulls, calved each time.

Of the two half-blood males, the authors only studied "Mischka", a typical intermediate form between American bison and domestic cow. The head, with a beard, strongly resembles that of the American bison. The tuft of hair at the lower part of the chest is also characteristic. The front legs have long hairs falling down to the knees. The horns are, however, like those of the mother (grey breed from the Ukraine steppes). The hump

(1) See also R., June 1914, No. 645. (Ed.)

is less pronounced than in the American bison, but is of the same type. The back and hindquarters are very like those of the American bison; the tail, intermediate between that of the American bison and that of the domestic cow, is shorter than in the European bison. The skin is of a dark colour.

Amongst the half-blood females, one ("Steraja", obtained by the cross American bison  $\times$  grey cow of Ukraine steppes) well shows the type intermediate between the parents, although its characters are less marked than in the male progeny. This animal resembles an ordinary cow much more than its brother does an ordinary bull. The head, which is bearded, resembles that of the American bison; the chest has a tuft of hair. The horns are those of the domestic cow. The thorax is shaped generally like that of the cow, and the hump is not pronounced. The hindquarters recall those of the American bison; on the contrary the tail is more like that of the cow. The colour is dark.

Another half-blood female, "Podpalaja", is clearly different from the preceding one, for it is the daughter of another American bison and a Shorthorn cow. It resembles the cow much more than the first, especially in the head. The beard and the tuft of hair on the chest are not much developed; the animal has a hump. The general colour is black, with white splashes on the belly and lower chest. HENSELER's observation that, in crossing Shorthorns with various wild forms (gayal, yack, etc.) the stripes sometimes seen in Shorthorns appear, has not been confirmed in this case.

The half-blood female, "Staraja", crossed with an American bison gave a heifer calf, "Slepaja", which is a  $\frac{3}{4}$  blood female bison. This animal is more like a female American bison than a cow. The head is that of the American bison, the neck and beard are strongly developed; the lower part of the chest had a heavy tuft of hair. The horns have, like these of the  $\frac{1}{2}$ -blood forms, the characters of the horns of the domestic cow. The hump is small and the hind-quarters resemble those of the bison. The colour is like that of the American bison but is lighter on the hindquarters.

On crossing the half-blood female "Podpalaja" with a Shorthorn bull a female ("Belaja") was obtained with  $\frac{3}{4}$  Shorthorn and  $\frac{1}{4}$  American bison blood. This animal so closely resembles the ordinary cow that its hybrid character cannot be determined at first sight. White colour. The only characters recalling the grandfather (American bison) are the hump and the tuft of hair on the lower part of the chest.

As regards temperament, all the hybrids (including the  $\frac{3}{4}$  Shorthorn cow) resemble the American bison most.

CROSSES BETWEEN EUROPEAN BISON AND DOMESTIC COW. — A half-blood male ("Herkules"), son of a European bison and a grey Ukraine cow, was sterile, and so was castrated, like the half-blood American bison. It resembled the European bison much less than the half-blood American bison does the American bison. The head is that of the cow but it has a beard and there is a tuft of hair on the chest. From the length and shape, the horns are of the bovine type. There is a hump, but it is smaller than in the European bison. The general constitution and colour make it an intermediate form between European bison and Ukraine cow.

A half-blood female ("Galka"), out of another European bison and another grey Ukraine cow, shows similar characters, and resembles rather the domestic cow. The head is that of the cow and the horns are those of the Ukraine cow. From the father are derived the beard and tuft of hair on the chest. The body is similar to that of the cow, but there is a well developed hump. The animal is coloured like the mother.

Another half-blood female ("Dunja"), out of a European bison and a grey Ukraine cow, has similar characters, but on account of the animal's youth they are less pronounced. The colour is not grey, but black.

The half-blood female "Galka" crossed with a European bison gave a bull calf ("Otboj") with  $\frac{3}{4}$  European bison blood. Allowing for its small size and other characters showing mediocre development, it is fairly distinct from the half-blood forms; it is most like the European bison. Both head and chest are very hairy, and the horns are of the cow-type. The hump and hind-quarters completely recall the European bison, while the colour is more like that of the cow. On the whole, this male resembles a European bison most.

A  $\frac{3}{4}$  blood female ("Golubka"), out of the  $\frac{1}{2}$ -blood female "Galka" and another European bison, has the same characters as the male "Otboj", but temperament, horns and colour are most like those of the European bison.

"TRIGENOUS" HYBRIDS BETWEEN EUROPEAN BISON, AMERICAN BISON AND DOMESTIC COW. — These are the progeny of the half-blood females (whose father was an American bison and mother a cow) crossed with a European bison. The males have not yet been used for reproduction, but they should be fertile as the sperm of one male contained normal spermatozoa. The females are certainly fertile. The authors describe some of the hybrids.

The male "Bjelmordij" differs from the half-blood American bison and the half-blood European bison by many characters. The head and strongly hairy coat recall the wild American bison, but in most of the characters it resembles the European bison. The beard and tuft of hair are as well developed as in the European bison, but the front quarters are less hairy than in the two species of bison. The horns are like those of the cow; the colour is dark, as with the European bison. This is a most original form, which most resembles the European bison (not as much, however, as the  $\frac{3}{4}$ -blood male "Otboj"), but showing a notable maternal influence.

Another male, "Petjka", is very similar to the previous one, but is smaller. The difference is seen in the fore-quarters (nape, neck, chest) which are more like those of the cow.

In a third male, "Dubass", the characters are the same as in the previous one; the hair of the head and fore quarters most resemble those of the male "Bjelmordij".

Another male, "Martin", has characters very different from the 3 previous ones. The hair on the body and fore-quarter is less developed, the horns smaller, but the hump is bigger and the tuft of hair is longer. As this animal is still young, some of its characters may change in time.

A female, "Lyssa", has, like all the females, less hair on the head,

so that it is more like an ordinary cow. The beard and tuft of hairs on the chest are well developed, however, and the horns resemble those of the European bison. On the whole, the characters incline more towards those of the European bison.

The author describes a "trigenous" female ("Tschubataja") which does not contain  $\frac{1}{4}$  cow's blood like the previous ones but  $\frac{1}{8}$ . The head is, broadly speaking, like that of a female produced by the cross American bison  $\times$  European bison. The horns are just like those of the American bison. The lower part of the chest and the upper parts of the fore-quarters are very hairy. The tail is like that of the European bison but is shorter; the part between the root and the tuft has the character peculiar to crosses between American bison  $\times$  domestic cow. On the whole, the female "Tschubataja" mostly resembles, not the pure blooded European or American female bison, but the female "Sanka" given by the cross American bison  $\times$  European bison. As "Sanka" has  $\frac{1}{2}$  American bison blood and  $\frac{1}{2}$  European bison blood and "Tschubataja" has  $\frac{1}{2}$  American bison,  $\frac{3}{8}$  European bison and  $\frac{1}{8}$  domestic cow, the resemblance of the two hybrids is easily explained.

In conclusion, the authors give measurements of 12 crosses (American bison  $\times$  cow, European bison  $\times$  cow, "trigenous" hybrids), but give the warning that they are not all reliable.

1383 - Comparative Yield of Cattle Before and After Fattening. — GOUIN, A. and ANDOUARD, P., in the *Comptes Rendus des Séances de l'Académie d'Agriculture de France*, Year IV, No. 18, pp. 556-557. Paris, 1918.

CATTLE

Under ordinary conditions the new-born calf requires less than 30 months to attain a weight of 500 kg., after utilising 2 600 kg. of food material.

The 500 kg. live weight does not represent more than 185 kg. of food stuffs, protein and fat, the surplus consisting mainly of water. The proportion of fat is then about 8 %, or 40 kg. out of the weight of 500 kg.

If the animal is fattened, suitable foods being available, the live weight should be increased from 500 to 600 kg. in 100 days, with a minimum of 25 % fat, or a total of 150 kg.

The 110 kg. (150-40) of fat thus gained required the following food material: —

- |   |           |
|---|-----------|
| 1) Material forming the fat, 100 kg $\times$ 2.27 . . . . .   | 249.7 kg. |
| 2) Work expended in forming the fat, of a value equal to twice that of the food. . . . .  | 499.4 kg. |
| 3) Maintenance of body for 100 days; average weight of 550 kg. corresponding to a surface area of 6.49 sq. decimetres . . . . . | 324.5 kg. |

Total . . . 1073.6 kg.

The daily food requirement is equal to 1.05% of the body weight; which agrees with the figures of the German school.

Thus, the unfattened bullock provides 185 kg. of food material for

human consumption, after consuming 2600 kg., while the fat bullock gives nearly 250 kg. more, against a consumption of 3 674 kg. of the same foods.

*Fattening increases the yield of the animal by 135 %, while the cost of its food only increases by 40 %.*

1384 - **An Experiment in War Time Beef Production, in Great Britain.**—WOOD, T B, in *The Journal of the Board of Agriculture*, Vol XXV, No 5, pp. 549-560 + 1 Table, London, August, 1918

The experiments described were undertaken to determine the minimum amount of cake required for winter beef production. The only previous direct experiment on the subject is one carried out at the Norfolk Agricultural Station in 1908, when 10 steers on a ration of 1 ½ cwt. of roots, 10 lb. of chaff and 1 lb. of cotton cake per head per day, gained 1 ¼ lb. in live weight per head daily for 20 weeks. During this period they produced 78 tons of dung of good manurial value.

The trials were carried out at two stations in Norfolk (Norfolk Agricultural Station, Little Snoring and Field Dalling), two stations in Scotland (Spencerfield and Craibstone), and three stations in Ireland (Ballyhaise, Athenry and Glasnevin). Two and a half year old steers were fed on as many roots and as much straw as they would eat, supplemented with only 1 ½ lb. per head per day of undecorticated cotton cake. Where possible the weights of litter consumed and of dung produced were recorded, and the animals slaughtered under such conditions that their carcass weights could be determined. Beyond these points the ordinary practice of the district in which the experiment was made was adopted, so that, though the method of feeding did not agree in every detail, the results show the increase in live weight which may be made by 2 ½ year old steers on a cake ration of 1 ½ lb. when the rest of the ration varies according to local practice.

Five of the results were extraordinarily uniform, showing an increase in live weight of from 8 to 10 lb. per head per week. In two cases (Norfolk Agricultural Station and Athenry) this rate was greatly exceeded (17 lb. and 15 ½ lb. respectively) possibly, in the first case, because a fair ration of good, long hay was given. At Glasnevin the rate of increase was much smaller (5 ¾ lb.), possibly an account of the small ration of roots. On the whole, the experiments showed that with a liberal allowance of roots and either good oat straw or hay, supplemented by 1 ½ lb. of cake per head daily, an average increase of about 1 ¼ lb. per head per day may be relied on in the case of good quality steers of 2 ½ years or more. It is not yet known whether younger animals would give similar results. In 15 to 20 weeks the animals will yield about 56 % of dressed carcass, which entitles them to be placed in the first grade. If kept in covered yards they will produce about 7 tons of dung per head during the feeding period.

The results leave no doubt that beef may be satisfactorily produced if the animals are given 1 ½ to 2 cwt. of cake. The yield of meat will probably be within 10 % of the yield obtainable with a normal ration of cake. The Scotch results suggest that beef can be produced from roots and straw with no cake at all, but the yield of meat will probably be reduced by a



further 5 % (a total of 15 %) below the yield obtained with a normal ration of cake.

The financial statements given show the cost of the stores, which amounted to 70% of the cost of the finished animal, to be by far the largest item in the total cost of beef production. If, therefore, stores can be bought at a reasonable price, say at 5s. per live cwt. below the selling price of beef, economic feeding should result in the production of dung at a reasonable price. The food is the next most important item and amounted to nearly 24 % of the total cost of production even with the low cake ration used. Labour and litter amounted to about 3% each. Though, from an economic point of view, it is desirable to economise in food and labour, by far the most important point is to economise in buying the stores, which should cost at least 5s. per live cwt. less than the price at which the finished animals will be sold.

1385 — “Woolless” Sheep as Butcher’s Animals in Cuba. — DE CASTRO, R., in the *Revista de Agricultura, Comercio y Trabajo*, Year I, No. 8, pp. 435-436 + 2 Figs Havana, August, 1918.

SHEEP

The author thinks that sheep rearing in Cuba should be intensified so that a more abundant supply of meat may be rapidly obtained and to profit from the many uncultivated or uncultivable areas still existing in the island. But as the wool breeds usually reared suffer either from the heat or ticks which hide in the fleece the author suggests the use of “Woolless” or “Barbadoes” sheep, originating in Africa, acclimatised at Barbadoes (Antilles) and introduced from thence into the United States. This breed is quiet, hardy, strong, and very prolific, since it lambs all through the year, producing from 1 to 5 lambs. They have no horns and the skin is covered with coarse, slightly wavy hairs. They seem excellently suited to warm climates. At Porto Rico they have given good results; in the experimental station of the island they have been crossed with the native wool breed, which is selected for meat production, and crosses have been obtained, in the majority of which the characters of the native race prevail, except for the fleece, which was absent.

1386 — Substitutes in Swine Feeding, in Canada. — I. ROTHWELL, [G. B., *Economical Substitutes in Swine Feeding*, in *The Agricultural Gazette of Canada*, Vol. V, No. 5, pp. 440-446 + 2 Plates. Ottawa, May, 1918 — II. TRUEMAN, J. M., War-time Hog Rations, *ibid.*, p. 479 + 2 Tables.

PIGS

I. — For several years numerous experiments in the feeding of pigs have been carried out at the Central Experiment Farm, Canada, and the paper under review gives a summary of the results obtained which may suitably be adopted under the food-shortage conditions brought about by the war.

Cottonseed meal, gluten feed, linseed oil meal and distillers' grains may possibly be obtained, though only in limited quantities. They give good and economical results when added to a basis maize, shorts, barley ration in the following proportions: — gluten feed 20 %, linseed oil meal 17 %, cottonseed meal 13 %. Good results were also obtained with 20 % of distillers' grains. An increase in the percentage of linseed and cottonseed

meal added causes protein poisoning, though as much as 30 % of gluten feed may be given. Maize oil cake, when procurable, is an excellent concentrate fed with shorts, or bran and skim-milk. Maize bran may be profitably fed to brood sows or fattening hogs, but not in quantities exceeding 20 %. Consistently good results were obtained with buckwheat screening which, when fed with skim-milk proved about equal to a standard ration of maize shorts and oil-cake.

It is not possible to vary very greatly the normal rations of young pigs. Skim-milk appears to be almost a necessity and cannot really efficiently be replaced by any other food. Tankage may, however, be regarded as a milk substitute. The best results were obtained when pigs were weaned without milk by supplying meal dry in a self-feeder, part of which was partitioned off and filled with dry tankage which was consumed as required. Water was freely supplied. The chief value of tankage is as a balance to grain. Middlings for the young pig may be replaced by 70 % shorts, 20 % maize meal and 10 % oil meal. With this, milk in some form is the one best food.

Feeding cut green crops to pigs is not advantageous on account of the labour it involves, and the fact that the feed soon becomes uneatable owing to exposure to the sun and soiling by the pigs, so that much waste occurs. Great advantage is, however, derived from pasturing. As a single pasture crop, alfalfa is unexcelled, though clover is almost its equal. Good results have also been obtained with rape as well as with heavy seedlings (3 to 3 1/2 bushels per acre) of barley, oats, or wheat. Of the cereals sown singly barley is the best pasture crop and, though a mixture of equal parts of barley, oats and wheat gives very good results, it is inferior to barley alone. A summer pasture of alfalfa, clover, or a spring-sown grain or grain mixture is a cheap self-harvested feed for growing pigs. Late summer and autumn pasture should be supplied by rape. An acre will pasture from 10 to 15 hogs in the growing season. An experiment showed the cost per 100 lb. gain to be reduced from \$ 5.30 in paddock feeding to \$ 3.54 in pasture feeding.

Skim-milk is the best single food for the growing hog, but buttermilk, fed fresh, is its equal. For a hog of 60 lb. or over, 400 lb. of skim-milk is equal to 100 lb. of meal. Whey also gives satisfactory results and, if fed fresh, 100 lb. will replace 19.2 lb. of meal. Skim-milk should not be overfed. With young pigs the best results are obtained with 1 lb. of milk to 2.5 or 3 lb. of meal; for a 100 lb. or more hog not more than 5 lb. should be fed daily. Milk should be fed sweet to very young pigs, but later there is little difference between sweet and sour milk so long as one or the other is fed consistently. Buttermilk and whey should be fed fresh.

Except in the case of the young pig, feeding twice daily is preferable to three times. Economy is effected by the use of a well-designed self-feeder; a combination of pasture, or successive pastures, with milk by-product and grain self-fed is specially recommended. During the pasture season if grain is self-fed 1 acre of land will carry an average of 4 000 lb. live weight of hogs. A series of experiments made in 1917 gave the following results for meal and milk trough-fed, meal and milk self-fed, meal and tank-

age self-fed, respectively :— Average daily gain, 0.85 lb., 1.05 lb., 0.53 lb.; meal eaten per lb. gain, 1.51 lb., 1.79 lb., 3.9 lb.; skim-milk per lb. gain 5.2 lb., 3.1 lb., —; cost per lb. gain 4.8 c., 5.3 c., 10.1 c.

II. — For three years the Nova Scotia Agricultural College has made experiments in feeding pigs on grain, skim milk and mangels. The results showed that gains can be made with a comparatively small amount of grain and with less total digestible nutrients than when grain is fed alone. The tables given show that 100 lb. of gain was made with an average of 148 lb. of grain, 900 lb. of skim milk and 110 lb. of mangels, containing 201 lb. of digestible nutrients. Quite a small amount of feed was given when the pigs were only 6 weeks old, but when they neared the age of 24 weeks (200 lb. or over) they consumed as much as 4 lb. of grain, 15 lb. of skim-milk and 4 lb. of mangels per day. The average daily consumption between the ages of 6 weeks and 24 weeks was 2.2 lb. of grain, 12.9 lb. of skim-milk, 1.6 lb. of mangels.

1387 — **Fish Meal as a Feed for Swine** (1). — ASHBROOK, FRANK G., in the *U. S. Department of Agriculture, Bulletin* No. 610, pp. 1-9. Washington, December 7, 1917.

The value of fish meal as a feed for pigs has been recognised for some years past, especially by Germany, which used it for this purpose to a far greater extent than any other nation. The experiments described were carried out at the Bureau of Animal Industry Experimental Farm, Beltsville, Md. to compare the value of fish meal and tankage as supplementary rations and to test the value of fish meal as a supplement to dried potato.

I. — *Comparison of fish meal and tankage as supplementary rations.* — Twelve grade Berkshires of uniform size, age, and breeding were used. The experiment was divided into two periods, a growing period of 112 days from weaning to fattening age, and a fattening period of about one month. The pigs were about three months old at the beginning of the experiment.

During the growing period the pigs were divided into two lots — 1 and 2 — of 8 and 4 pigs respectively. Lot 1 was fed 4 parts maize meal, 4 parts middlings and 1 part tankage, and Lot 2, 4 parts maize meal, 4 parts middlings and 1 part fish meal. Lot 2 made a greater daily gain per pig (1.31 lb.) than did Lot 1 (1.25 lb.), and at the end of the experiment the average difference in weight was 10 lb. in favour of fish meal. Lot 1 ate slightly less grain per pig daily (4.53 lbs.) than Lot 2 (4.80 lb.). There appeared to be no difference in growth or general development between the two lots, showing that there was little to choose between the rations.

During the finishing period the same 12 pigs were divided into 3 lots of 4 animals and fed as follows :— Lot 3, 4 parts maize meal, 4 parts middlings, 1 part fish meal; Lot 4, 9 parts maize meal, 1 part fish meal; Lot 5, 9 parts maize meal, 1 part tankage. Lot 4 made the highest daily gain per pig (2.16 lb.), Lot 5 the next highest (2.00 lb.) and Lot 3 the lowest (1.91 lb.). The grain consumed per 100 lb. gain was :— Lot 5, 462.00 lb.; Lot 3, 421.00 lb.; Lot 4, 393.00 lb. It will be seen, therefore, that the best results were obtained with 9 parts maize meal + 1 part fish meal.

See also R. Dec., 1916, No. 1301; R. June, 1917, No. 565. (*Ed.*)

2. — *Fish meal as a supplement to dried potato.* — Twelve high-grade Berkshire pigs between 5 and 6 months old were divided into four lots of three pigs and fed the following rations: — Lot 1 (check lot), 6 parts maize meal, 1 part tankage; lot 2, 6 parts dried pressed potato, 1 part tankage; Lot 3, 6 parts dried pressed potato, 1 part linseed oil meal (old process); Lot 4, 6 parts dried pressed potato, 1 part fish meal. The average daily gains were: — Lot 1, 1.57 lb.; Lot 4, 1.32 lb.; Lot 3, 0.91 lb.; Lot 2, 0.80 lb. The rations fed per 100 lb. gain were: — Lot 1, 403 lb.; Lot 4, 428 lb.; Lot 3, 584 lb.; Lot 2, 605 lb. The most rapid and economical gains were made with 6 parts maize meal + 1 part tankage, though those made with 6 parts dried potato + 1 part fish meal were not much inferior.

At the end of the experiment the heaviest animal from each lot was killed to determine the quality of the flesh and fat and the degree of finish. In no case did the meat have any fishy smell or taste.

These results show that, where it can be obtained at a reasonable price in suitable quantities, fish meal, if used in proper proportions, should become one of the most popular and economical supplements for feeding pigs.

## POULTRY

1388 — *The Part Played by the Egg Shell of the Hen in the Formation of the Chicken's Skeleton During Incubation.* — DELEZENNE, C. and FOURNEAU, E., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 9, pp. 413-429 + 7 Tables. Paris, 1918.

It is known that the fresh hen's egg contains little lime (CaO), usually not more than 35 mgm. for an egg weighing 60 gm. It may, therefore, be asked: — 1) how can the chick form its skeleton with so small a quantity of lime; 2) if the chick contains more lime than was present in the interior of the egg during incubation, whence has it obtained it? A review of the chief work done on the subject (PROUT, GORLEY, VOIR, PREYER, VAUGHAN and BILLS, TANGEL) show how greatly the opinions vary as to the part played by the egg shell in the formation of the chick's skeleton: some refuse to admit it, while others take it as proved.

Owing to these diverging opinions, the authors have reopened the question. They have estimated the lime in the contents of a large number of eggs. These, placed in an incubator, were removed successively on the 10th and 12th day of incubation (when ossification of the skeleton begins), then regularly each day from the 14th to 21st day (hatching). To control the results the authors used eggs other than these of the hen, such as duck and peahen. The results, given in tables, show: — 1) the weight of the fresh egg; 2) the lime in the contents of the egg on the day of sampling; 3) the lime in proportion to 100 gm. of whole egg weighed at the moment of laying; 4) for certain samples, the total percent of phosphorus in the entire egg.

The results are very clear and lead to the following conclusions: —

1) The lime in the content of the egg increases about 500 % during the whole time of incubation. This increase begins to be traceable about the 10th and 12th day of incubation, is very marked about the 16th and 17th days and then continues regularly until hatching.

2) In the unfertilised hen's egg put to incubate, the % weight of lime

after 21 days is the same as in the fresh egg ; no trace of lime passes from the shell to the interior of the egg.

3) In peahen eggs, the increase in the lime content during incubation was 500 %, while, in duck eggs, it was slightly below 400 %.

4) The phosphorus does not increase during incubation.

These experiments clearly show that the physiological role of the egg-shell of birds consists in supplying the embryo with a lime reserve, which the embryo utilises during incubation in a way as yet unexplained. But it may be said that "the modifications undergone by the vitellus and albumin during incubation take place in a regular rhythm, during which a substance is freed in determined amounts and which has the power of dissolving a determined amount of the lime of the shell".

This substance might be an acid, a sugar, or allantoin. But the authors think that the solution may be obtained by a minute analysis of the amniotic liquid, which, in fact, about the 17th day of incubation, at the moment when the solution of the lime increases, is alone in contact with the shell through the egg membrane.

1389 - **Final Report of the Fourteenth Egg-Laying Competition Held at the Queensland Agricultural College, Gatton, from April 1, 1917 to March 31, 1918** (1). — *Queensland Agricultural Journal*, Vol. IX, Pt. 6, pp. 213-225 + 10 Figs. Brisbane, June, 1918.

In the 14th competition 438 birds competed, 318 in groups of 6 and 120 singly. The advantage of this last method was again confirmed and the group system must be considered obsolete. The weather conditions were very unfavourable and the quality of the food poor. The hens showed a strong tendency to brood, perhaps as a result of the continual wet weather. In short, the results were not very satisfactory. The average yield per hen was the lowest yet recorded in the Gatton competitions. The total was 83 868 eggs or 191.5 per hen in one year. The maximum yield from the light breeds, represented by White Leghorns only, was 1652, or 275.3 per head. The first place among the heavy breeds was taken by Black Orpingtons with 1470 eggs or 245 per hen. Two new records were made — one Black Orpington laid 335 egg in 365 days and one group of six White Leg-

(1) For the results of the competition held from April 1, 1913, to March 31, 1914, see R. 1915, No. 82. In the competition held from April 1, 1914 to March 31, 1915, for which were entered 240 hens, including 192 White Leghorns, 54 202 eggs, or an average of 226 per hen, were laid throughout the year. The first three groups of 6 hens gave 1545, 1544 and 1534 respectively. Only four groups gave less than 1200 each (*Queensland Agricultural Journal*, Vol. III. Pt. 6, pp. 241-244. Brisbane, June, 1915). In the competition held from April 1, 1915 to March 31, 1916, for which 53 groups of 6 hens (318 hens) were entered, the total number of eggs laid was 70 848, or an average of 222.8 per hen. The first three groups (White Leghorns) gave 1530, 1530 and 1481 eggs respectively. Only six groups gave less than 1200 eggs. These competitions showed the light Mediterranean breeds to lay best. In competitions they should, therefore, be separated from the less active large Asiatic breeds. The necessity of breeding hens with a view not only to their laying capacity, but also to their general vigour and trueness to type was likewise shown. (*Ibid.*, Vol. V, Pt. 6, pp. 316-322. Brisbane, June, 1916) (*Ed.*)

horns laid 1661 eggs, or 277 per hen in one year. In both cases the birds were disqualified for prizes because the eggs were below the standard of 24 oz. the dozen. The competition showed the necessity of not sacrificing the size of the egg to the size and vigour of the hen and, consequently, to fertility.

The food consumed by the 438 hens throughout the year was: — wheat 296 bus., maize 42 bus., hulled oats 15 bus., skinless barley 9 bus., pollard 420 bus., bran 196 bus., oilcake 4 cwt., desiccated meat 2 cwt., bonemeal 1 ½ cwt., dried blood 4 ½ cwt., green lucerne, and soup meat.

## BEE KEEPING

1390 - **The Artificial Feeding of Bees with Pollen.** — USAY, J., in the *Illustrierte Monatsblätter für Bienenzucht*, Year XVIII, No. 5, p. 35. Vienna, 1918.

It is known that in spring bees use a large amount of pollen for feeding the hive. As, in many countries, flowers are rare at this period and the workers are impeded by the bad weather, the author advises the provision of pollen for the bees. This was suggested to him by the fact that many beekeepers spread in front of their hives flour, which is eagerly gathered by the bees. At the flowering season of resinous trees, which produce abundant pollen, the author shook cones over a box cover, thus obtaining an abundant supply of pollen, which he kept in a dry room till the following spring. When this dust is spread on a board in front of the hive in fine weather the bees immediately collect it. The author has observed no ill effects as a result of this food.

## SERICULTURE

1391 - **The Creation of an Interministerial Silk Committee, in France.** — *Journal Officiel de la République Française*, Year L, No. 262, p. 8417. Paris, September 26, 1918.

By the decree of September 20, 1918, there was created in France an Interministerial Silk Committee controlled by the Minister for Commerce and composed of 21 representatives of the various Ministries as well as of the silk trade and industry.

Its functions are (art. 1):—

- 1) To suggest, centralise, co-ordinate and indicate measures for assuring to France a supply of silkworm eggs, raw silks, worked silk, silk by-products and articles made in silk;
- 2) To establish, in agreement with those using silk in its different forms, and with traders and manufacturers interested, those products that should be given priority and to indicate the relative urgency;
- 3) To indicate measures to be taken to provide for such needs according to the orders of priority;
- 4) To carry out the same study and exercise the same control for artificial silk;
- 5) To suggest any other action that may be required.

1392 - **Influence of the Breed of the Eggs on the Cleanness of Raw Silk.** — FURUMOTO, J., in the *Bulletin de l'Association sericicole du Japon*, Year III, No. 1, pp. 1-4. Tokio, April 15, 1918.

For a long time Japanese silk has been criticised for its too large number of knots. From this point of view Japanese silk is much inferior to

that produced by other countries, not only France and Italy but also China.

There are many causes that combine to produce knots and down on Japanese silk, but the chief one is the damp air in that country. Thus when winding or drying and preserving the cocoons in Japan it is highly necessary to maintain a very even temperature, still more than in continental countries such as France, Italy and China, where the atmosphere is generally dry. As this has been done the defects have been found to have largely diminished.

The author (engineer at the Yokohama Silk Conditioning House) gives figures showing the variations in the numbers of knots between 1900 to 1916 inclusively. On an average, in 1900, out of 500 metres of thread there were 3 knots and 265 downy spots, while in 1916 there were only 0.9 and 146 respectively.

The number of large and small knots tends gradually to diminish, which shows a great progress in the art of spinning. The number of defects began to decrease especially after 1912.

The author thinks that this good result may be due mostly to the propagation of first generation hybrids, which is so marked of late years that it constitutes a veritable revolution in the Japanese silk industry.

So as to test this hypothesis the author divided the silk-producing regions into 2 classes, one including the regions where first generation hybrids are in favour, the other including those where cocoons produced from native eggs are still numerous, and he has compared the silk produced by the 2 classes as regards its cleanness. There was a decrease of 41.9 % of knots in the regions where hybrids are more widely diffused than native eggs and a decrease of 32.8 % in those regions where there is still a fairly high proportion of native eggs.

1393 — On the Possibility of Rearing the Manatee as a Food Animal in French West Africa (1). — MENEGAUX, A., in the *Comptes rendus des Séances de l'Académie d'Agriculture de France*, Vol. IV, No. 24, pp. 698-705. Paris, July 3, 1918.

OTHER  
LIVE STOCK

Attention is first called to the experiments made by Dr. BELL in 1916 and 1917 in Florida on rearing the American manatee (*Manatus latirostris*) in half-stabling in the lagoons, experiments showing that this animal might by very valuable as a butcher's animal.

The African species, or Senegal manatee (*M. Senegalensis*), inhabits all the estuaries and lagoons from the mouth of the Senegal up to the river Cuenze, in Angola and often going considerable distances up the rivers. It thus occurs on all the coasts of Gambia, Liberia, Ivory Coast, Cameroons, Gabon, in the Ogoové, Congo and even in lake Tchad. Morphologically it is little different from the American manatee, while the habits and structure

(1) See R., Dec., 1917, No. 1200. In that article read "manatee" instead of walrus. The walruses or Trichechidae are arctic and circumpolar Pinnepedia. They are carnivorous. The manatee, however, belongs to the Sirenia (e. g. *Manatus latirostris* of America and *M. senegalensis* of Africa); they live in the fresh waters along the Atlantic coasts of America and Africa; they are herbivorous. See *Cambridge Natural History*, Vol. X, Mammalia. (Ed.)

are identical; however, no specimens have been reported so large as those in America. Its food plants are not sufficiently precisely known, but as *Cymodocea nodosa* occurs in all the lagoons and estuaries where it dwells, there is reason to suppose, by analogy with what happens in America, that it browses exclusively on that plant. In captivity it eats vegetables such as lettuce, cabbage, celery tops, baked apples, spinach, and even bread.

The African manatee measures from 10 to 20 feet and its weight varies from 660 to 1650 lb. for old males. These animals are monogamous; the period of gestation lasts 8 months and the young are born in shallow lagoons where the mother can breathe without being forced to come to the surface. The family consists of 4 individuals: the adult pair, one half-grown and a calf, generally born in the autumn.

The meat of the manatee, like that of the dugong, and to the contrary of many new meats, has been liked by all those who have tried it; it has been compared to veal cutlets, to pork or tender beef; it is white, delicate and of a delicious taste; it is the meat of an herbivorous animal. When it is salted it is like excellent bacon with good keeping properties.

The tail, especially that of young animals, is a great delicacy when pickled and eaten cold; the sucking animal gives very delicate meat. The whole body is surrounded with a  $1\frac{1}{2}$  in. layer of blubber, which gives an oil said to be equal to that of cod liver oil, having, moreover, the advantage of being odourless, tasteless, clear, and limpid as well as of not going rancid; it, however, contains no iodine. The bones are very compact and could replace ivory. Some 85 % of the body of the manatee can be used as food; a manatee yields almost as much eatable meat as a steer.

The African manatee can be reared practically and it is to be hoped that the Governments of the African colonies will study the subject. In the first place it would have to be found out whether *Cymodocea nodosa* exclusively forms the food of these animals; if it contains iron, like the American species; where it best lives and if such are places where the manatee would live by preference. It would then be quite easy to fix on lagoons where stabling would be possible without too great cost, whether for starting or up-keep.

## FARM ENGINEERING.

AGRICULTURAL  
MACHINERY  
AND  
IMPLEMENTS

1394 - The Function of Agricultural Engineers as regards the Makers of Power-Farm-  
ing Machinery. — CORÉ, Lieutenant, in *Produire*, No. 5, pp. 158-160 + 1 Fig. Paris, July  
5, 1918.

Considerations of a purely agricultural order are of capital importance to makers and it appears from a perusal of technical treatises on power farming that mechanical engineers have not had such detailed information as would allow them to take such considerations into account in their researches. It is indispensable that the makers should be supplied as early as possible with all the desired information so as to avoid feeling their way or following a line that would only lead to disappointments to farmers. Many essential points have yet to be cleared up in this order of ideas.



The supporters of power farming are divided into two groups, and it is at present impossible to say which will vanquish the other. For the one, the problem of power farming consists in the simple substitution of mechanical for animal traction in various ways, while preserving the principle of the plough sock as well as the present instruments of cultivation. For the other, on the contrary, the question is that of replacing the work of the plough share by that of tools, the nature of which does not seem very clear any more than that of the movements by which these tools should be worked.

For the first group, supporters of the plough, it is absolutely necessary to turn the earth to a certain depth before winter. The second group insist that the earth should not be turned, but pulverised to a great depth. This theory, containing the principle of "dry farming" seems to be most applicable to very dry soils and new soils.

Makers can, therefore, justly ask the agricultural experts to say which of the 2 methods, ploughshare, or special parts driven mechanically either with a rotary or alternately rectilinear movement is the best. So far it seems that both methods are of interest. If the experts cannot decide that one method is certainly better than the other, it ought at any rate to be possible for them to state in what regions and under what climates one or other of the methods is the more suitable from the purely agricultural standpoint. They could then easily deduce over what areas one or other of the methods should be employed; the makers would then be able to decide the importance of the outlets opening for them in the two cases, and run their works accordingly. The engineers have yet to provide them with more precise detail as regards indirect traction by cable and windlass as well as regards direct traction by a motor-tractor, the compression of the soil, and the working speed of the plough. In the case when the ploughshare is to be replaced by working members, driven through suitable mechanism, by an engine serving at the same time to propel the machine, the problem appears still more difficult. The author thinks that machines of this kind would only succeed in so far as the work they do (crumbling the soil) corresponds to the requirements of the land. If agreement is obtained on this principle, it remains to be settled how such crumbling should be carried out and to what degree of fineness and if the machine may not be required to have a digging action, all indications that can only be supplied by the farmer. According to the author light tractors of the Caterpillar type, in particular, seem indicated as immediately furnishing the best provisory remedy for the agricultural crisis. Tractors of the Caterpillar type have been used in large numbers for military purposes and have shown their worth. However, these machines could not provide a final solution of the problem of power farming; as such a solution could only be reached through long researches.

1395 - A Tractor School in Illinois, U.S.A. — *Farm Implement News*, Vol. XXXIX, No. 31, p. 18. Chicago, August 1, 1918.

The Farm Mechanics Division of the University of Illinois announces a series of short courses in tractors to be held between October 15, 1918 and

March 17, 1919. The schools will be held for 2-week periods, the number of pupils being limited to about 50. It is hoped to recruit the pupils from tractor owners, implement dealers and automobile dealers. The tuition will cost 2 \$ a week. The school will be under the direction of Prof. E. A. WHITE, instructor in farm mechanics.

1396 - **Restrictions on the Manufacture of Farm Implements in the U. S. A.** — *Farm Implement News*, Vol. XXXIX, No. 29, pp. 48-49; No. 30, pp. 12-13. Chicago, July 18 and 25, 1918.

The Conservation Division of the War Industries Board of the United States has published a schedule of farm implements and their parts which are to be eliminated so as to economise in labour and material.

The eliminations thus made apply : — 1) to grain drills and other seeding machines, fertiliser drills (only one size of broadcast fertiliser distributor can be made) ; none of these machines may be manufactured after Nov. 1, 1918; 2) partially to portable grain elevators, only one type being allowed; 3) to several types of ploughs, after Dec. 31, 1918, and especially to left-hand ploughs, which may not be made after July 1, 1918 (the sulky and gang ploughs are limited to a few types the most in demand) ; 4) to harrows, which are restricted to U-bar, channel bar and wood bar types; 5) to disc-harrows, save to 16-in. and 17-in. sizes, and those 4, 5, 6, 7, 8, 9 and 10 ft. long, the same applying to engine disc harrows. Tools used for raising sugar cane are not included in the list. The manufacturers are obliged to maintain and assure an adequate supply of repair parts of all types, sizes or types of implements becoming obsolete through these eliminations in order that farmers may be assured of necessary spare parts for a time in excess of the normal life of the various implements. Other eliminations are being planned for harvesters, mowers and rakes. From an inquiry made, it seems that one-horse mowers should be limited to the 3 ½ ft. bar type and that hand dump hay rakes should be no longer made as well as all sizes of binders save those of 6-ft., 7-ft. and 8-ft cut. The construction of 2 row drills for maize and beans is limited to 2 types, one 28 in. to 3 ft. 8 in., and the other 32 in. to 4 ft.; these are the maximum and minimum adjustments, intermediate ones being optional with each maker. Detailed regulations for the manufacture of maize drills, and cultivators of various types are also given.

1397 - **National Power Farming Show at Salina, Kansas, U. S. A.** — *Farm Implement News*, Vol. XXXIX, No. 32, pp. 30-48 + 72 Figs. Chicago, August 8, 1918.

The national power farming show was held from July 29 to August 2, 1918, at Salina, Kansas, U. S. A., 48 makers with 232 tractors taking part. The ploughing depth was only 4 inches. Half of the ploughs pulled were 3-bottom ploughs, the remainder having 2 and 4-bottoms. Disc ploughs were shown; it appears that the use of disc ploughs has much increased in Kansas of late.

This demonstration was the first of a national character where official prony brake tests were made. The tests began 4 days before the show was opened; the results will not be published, but each maker receives a report

covering the tests of his tractor or tractors, and which he can use as he thinks fit, except that he can not publicly make a comparison between his own figures and those relating to other machines. The Belgian, French, Italian and Peruvian governments sent official representatives to attend the show.

Technical reports will be published later showing the value of the show.

**1398 - Tests of the Cleveland Tractor at Montpellier, France.** — CLARON, C., in *Le Progrès Agricole et Viticole*, [Year XXXV, No. 23, pp. 150-153 + 1 Fig. Montpellier, August 18, 1918.

As the Cleveland tractor (1) had arrived too late to take part in the tests of vine cultivation by power at Montpellier, France, in 1918, it was tested separately at the School of Agriculture of that town.

During the tests in April, 1918, at Noisy-le-Grand, the tractor, on account of its small dimensions and the fact that it can turn in its own length was considered to be suitable for work amongst the vines. In tests among vines at Roche-de-Bran, near Poitiers (2), this tractor gave good results in rows 6 ft. 6 in. apart.

In this chain-track, 12-20 HP. tractor, the two driving wheels have been replaced by two pinions, which form the rear part of the machine and carry two chain tracks running over pulleys in front. Each track is 18 in. long and 7 in. wide and carries 44 teeth which act as spuds though not cutting. Owing to the gripping surface of each chain track (35.7 sq. decimetres) the tractor can work in any kind of soil. If the tracks wear on the macadam when used on the road, they have the advantage of not requiring, as do other tractors, a set of spuds or strakes to be put on to provide grip. The author says that, of all the tractors he has tried, the Cleveland is one of the easiest-starting ones. It is easy to drive and can turn in a circle of 143 in. diameter.

The tractor was tested on July 17, 1918, when it towed a 3-furrow EMERSON plough in a field that had been harvested a few days previously with a  $\frac{9}{16}$  CASE tractor towing a "La France" binder. The soil was in good condition, but dry and the plough worked shallowly from 4 to 7 in.

**RESULTS OF THE TRIALS.** — No dynamometric tests were made, but by comparison the author was able to estimate that the 3-furrow plough required a tractive effort of 550 kg.; when lifted it required about 70 kg.; the traction per sq. decimeter thus works out at about 37.6 kg. The absence of a coupling between tractor and plough was regrettable as it would have saved numerous shocks to the machine. When ploughing the machine ran at about 2.3 miles per hour; in the long run the motor might suffer from such violent work.

The running tests gave the following results:— revolutions per minute, 720 slow and 1 550 loaded; average depth of ploughing, 5 in.; average width, 38 in.; furrow length, 417 ft. going and 394 ft. returning; total journey, 1 621 ft.; total area ploughed, 5 167 sq. ft.; time required for ploughing, 5 minutes 7 seconds; time required per acre, 89 minutes; petrol consumed

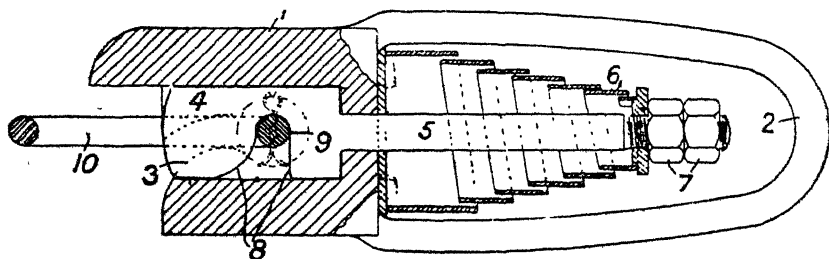
(1) See R., October, 1918, No. 1145. (Ed.) — (2) See R., Nov. 1918, No. 1267.

during trial, 0.239 galls ; petrol consumed per acre, 1.9 galls ; petrol consumed per 1000 sq. ft. ploughed, 1.03 galls ; soil turned per lb. of petrol, 1 263 cu. ft.

On order to calculate the time required to plough an acre, the totals of the various stoppages during ploughing have been calculated, according to the practice at the Montpellier School, at  $\frac{1}{4}$  hour of the total time necessary for the work. The results are excellent, according to the author, and allow the Cleveland to be classed among the best machines as regards its yield. Long duration tests will be carried out with this tractor near Montpellier. As the new type of chain tracks used in the Cleveland is so ingenious it is possible that they might decrease the wear for which chain tracks are blamed. The author considers that the Cleveland constitutes a distinct progress and should be considered amongst the chief tractors on sale in France at the present day.

1399 - **Couplings for Tractors.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXX, No. 4, pp. 112-114+3 Figs. Paris, July-August, 1918.

The author's researches on couplings have shown that a saving in traction for the engines can be made of 33 to 54 % on the starting effort and 10 to 30 % on the average tractive effort. If the use of couplings reduces the fatigue of animate engines it acts similarly on inanimate engines, for



SHANKLAND coupling.

which its use is shown by a saving in fuel estimated by the author at from 2 to 3s. per acre.

The author describes: (1) the coupling made by the "Ateliers BRILLÉ", 28, boulevard de Villers, Levallois-Perret (Seine), France. This spring buffer blocks at a pressure of 2 200 to 2 640 lb.

(2) The buffer proposed by M. D. SHANKLAND, Great Clyde St., Glasgow (1). With this coupling the tractor can be separated from the plough at the end of the journey. The pieces 1 of the figure reproduced, forming part of the shackle 2, carries a slotted member in which fits the part 4 united to the bolt 5 holding the spring 6 which is adjusted with the screw and lock-nut 7; the spring 6 is centered by means of the nuts 7.

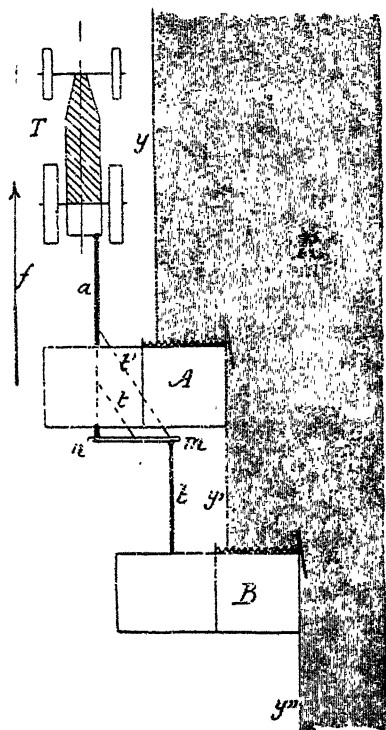
The attachment to the opposite side of the shackle 2 is by means of the hook 10 and the iron-pin 9 held in place by 2 keys. As the spring is com-

(1) See R., May, 1918, No. 566, Patent 112579 of the United Kingdom.

pressed by the pull, the pin 9, pulling the bolt 5, leaves the shoulder *a*, guided by two slits cut in the cheeks of part 1; the slits, at first straight, end in a curve shown by the dotted line 3. At the end of the journey of part 4, a little before the spring 6 is completely blocked, the pin 9 falls from the slits 3 and the hook 10 becomes free from part 4 and shackle 2; the tractor is then automatically detached from the plough thus avoiding breaking parts. The author has already remarked (1) on the similar automatically-unhooking coupling on the Hourioux system. All the devices for automatic unhooking are advisable provided they are neither too heavy, nor too complicated to make and consequently too highly priced or out of proportion to the desired aim.

1400 - **Harvesting with a Tractor.** — RINGELMANN, M., in the *Bulletin de la Société d'Encouragement pour l'Industrie Nationale*, Year CXVII, Vol. CXXX, No. 4, pp. 97-101 + 5 Figs. Paris, July-August, 1918

M. F. BOUCHARD, director of the Dieufit estate at Bellon-en-Houlme



Plan of tractor attached to two binders.

(1) See *Culture mécanique* by M. RINGELMANN, Vol. I, p. 16. Librairie Agricole de la Maison Rustique, Paris, 1913. (Author)

(Horne), France, has adopted a device shown on the appended figure for hitching 2 binders to a 16 HP. MOGUL tractor (1).

The shaft *a* of the first binder *A*, working on the width *yy'* is attached to the right of the tractor *T* running along the side *y* of the field.

At the rear of *A* is a cross-bar *mm* whose end *m* is held in permanent position by 2 braces *t* and *t'* which prevent the angle *anm* from opening; the tie-rod *t'* passes under the platform of the binder *A*. Near *m*, at the desired point, the shaft *b* is attached of the second binder *B*, which can thus turn round the point *m* and the whole machine moves in the direction shown by the arrow on the side *R* to be harvested, cutting over the width included between the parallels *y* and *y'*.

The mounting used for 2 MacCormick binders, cutting 59 in. to the right hand, enables them to turn in the smallest turning radius of the tractor. M. BOUCHARD turns outside to the right without cutting; the tractor begins to turn when the second binder is at the corner of the field to be cut. Before the machines enter, the field is cleared on a width of 22 to 26 ft. The author thinks that less width could be freed if the first turns were done with a single binder, even by only cutting the 2 long sides of the field; the second binder would be attached after sufficient space has been cleared.

With a 59 in. cut, on a width of 95 in., M. BOUCHARD cut as much as 7 176 to 7 296 sq. yd. per hour; a driver is required for each binder. The author recalls the MASSEY-HARRIS device for attaching a binder to a tractor. Instead of the ordinary pole used with a team, a frame in the shape of an isosceles triangle is fixed in front of the binder, the summit of the triangle pointing towards the carrying and driving side of the binder; the forward base of the isosceles triangle carries a horizontal screw working in a nut fixed to the shaft through which the machine is hauled. The screw is moved by a bevel gear and a pointed shaft ending in a wheel by the driver. The frame is prolonged under the binder frame by a bar to the back end of which the pole of the next binder is attached.

#### 1401 - Simultaneous Harvesting and Breaking-up of the Stubble with a Tractor. —

*Le Génie Rural*, Year X (New Series., No. 24), No. 84, pp. 7-8 + 2 Figs. Paris, 1918.

To hitch a 13-time MASSEY-HARRIS cultivator to a binder towed by an AVERY tractor (2), M. GRATIAUX, of Epervon (Eure-et-Loire), France, uses an iron bar 6 ft. 6 in long bolted on to the shaft of the binder and clamped behind on the binder frame. On the steering device of the cultivator are bolted 2 flat irons joined by a bolt to the end of the bar projecting from behind the binder. This device is to leave steering free in a vertical direction but to render it rigid horizontally, so as to allow the binder and cultivator to back if required.

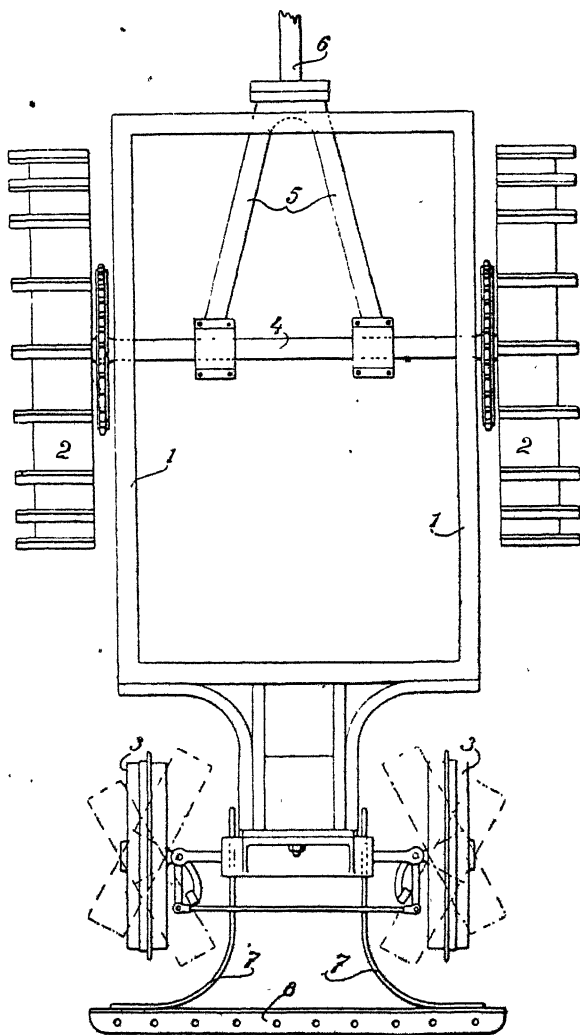
M. L. DANCAUD, of Levet (Cher), has designed a device similar to that just described and which is also intended to carry out 2 operations at once. Although less simple than the former, as it requires a special tractor, M. DANCAUD's device is said to constitute a great progress in mechanical

(1) See R. February, 1918, No. 201. (Ed.)

(2) See R., 1917, No. 945 (Ed.)



traction. Instead of towing the binder by a tractor and hitching a stubble breaker behind the binder the new arrangement makes it possible to attach the binder in front of the tractor and the stubble breaker behind. Thus



Plan of DANCHAUD tractor.

the tractor pushes one machine and pulls the other. One man can drive the tractor and supervise the working of the 2 machines. Moreover, as the binder is in front of the tractor, it can cut a greater width as there is no

risk that the tractor will pass over the uncut crop. Other machines that work suitably together can be used to replace the binder and stubble breaker (hay mower and hay maker, or one binder in front and another behind the tractor.

In addition the device is well suited to the direct driving of the working parts of agricultural machines in general and specially of binders and reapers by the tractor engine. The appended design gives a plan of the invention. The apparatus includes a frame on which is mounted the engine with the gear, drive and controls. The frame is mounted on two driving wheels 2 in front and 2 steering wheels 3 in the rear. In front of the frame two arms 5 are mounted on the axle 4 and carry a shaft 6 for connecting with the machine to be driven or partially or totally supported.

In the rear of the frame, the arched pieces 7 of the steering gear are mounted. These pieces have their end joined to a draw bar 8 for such agricultural machines as have to be drawn by the tractor.

**1402 - Log Saw.** — MANRIN, G., in the *Journal d'Agriculture pratique*, Year LXXXII, New Series, Vol. XXXI, No. 18, p. 355 + 2 Figs. Paris, September 5, 1918.

Log saws made by M. BIAUDET FORTIN, of Montereau (Seine-et-Marne), France. In the "Rustic" type of log saw the circular saw is mounted on ball bearings; the saw is 24 in. in diameter and is protected by a cover. The log to be cut is placed in a rectangular cradle whose frame is mounted on a horizontal axle placed lower down. Once the log is placed in position all the man has to do is to push it towards the saw, pressing more or less according to the hardness of the wood so as not to stop the machine or to make the driving belt slip.

To provide the military type of log, the War Administration uses similar saws driven by a petrol motor, the whole being carried on a truck mounted on 4 cast-iron rollers. The motor and its accessories are at one end of the truck, behind the water tank mounted on the tool box; the fuel tank is strengthened by oblique stays hooked to its upper edge and fastened below to the truck. The saw, whose frame is made of steel angle-irons, is bolted to the other end of the truck above the front wheels.

**1403 - An Improvised Pasteurising Plant.** — BALLHAUSEN, O. C., in the *Agricultural Gazette of New South Wales*, Vol. XXIX, Pt 2, pp. 128-130 + 1 Fig. Sydney, February 2, 1918.

An ordinary rapid pipe-cooler with 16 2-in. pipes, and 42-in. high and 54-in. long, has been transformed into a pasteurising plant by Mr. J. McDERMOTT, the Manager of the Bonalbo Dairy Company. The cold brine is replaced by hot water and live steam which are pumped through the pipes. To prevent the cream splashing on falling onto the heated pipes, two tinned sheets, 24-in. high and 54-in. long, were fitted close against the pipes. The top edges of the sheets are bent outwards while the lower edges are bent inwards. A depth of 18-in. at the bottom of the heater is not covered by the sheets, the idea being to allow the gases and steam arising from the heated cream to escape.

The cream passes off the heater into the tanks at from 160 to 170° F;



450 gallons an hour can be heated to 160° F. Cooling is carried out in the same machine, bang continued till the cream is at 48°F. The day after the cream is churned at the same temperature.

Mr. L. T. MAC INNES, the Acting Dairy Expert, found the butter made from cream thus treated to be of choicest grade and to have no cooked flavour at all.

**1404 - Equipment for the Commercial Evaporation and Drying of Fruit in the U. S.**  
A. — BEATTIE, J. F. and GOULD, H. P., in the *U. S. Dept. of Agriculture, Farmers' Bulletin* No. 903, 60 pp. + 22 Figs + Bibliography of 20 Publications. Washington, September, 1918.

Although intended for those who contemplate engaging in the art of drying or evaporating fruits or vegetables, this bulletin contains very useful information for all who wish to dry fruit for home use. The authors describe the various types of equipment for drying fruits or vegetables, as well as the methods of heating that are most used and which have given the best results taking their simplicity and economy into account.

The driers used in the apple-drying industry of the eastern portion of the United States are for the most part of the kiln type. The almost universal use of this type is due to the low first cost of the kilns and the small amount of labour required to operate them. In an area of western New York there are some 2 000 commercial driers, 500 being large plants; about 75 % of the evaporated apples produced in the eastern portion of the United States come from this area. Other States, such as Virginia, Illinois, Arkansas and Missouri, also produce considerable quantities of evaporated apples, most of which are prepared in kiln driers.

The modern kiln consists of a structure two stories high, the ground floor being occupied by the furnace while the second floor serves as the drying room. The construction of the building, the air ducts, the drying floor, the drying plant, are all described in detail, plans and figures being also given.

The steam-heated cabinet drier has been found to be a more efficient type as well as being adapted for use in any locality. There are 6 rows of steam pipes spaced so as to admit two trays between every two rows of pipes. The description of this drier is accompanied by figures showing the construction and working details.

Tunnel driers require more labour, and for this as well as other reasons they have never come into general use in the apple-drying districts of the eastern portion of the United States. They are suited for drying cherries, maize or other material best handled by spreading on trays.

The bulletin describes the preparation of fruit for evaporation, the evaporation of the fruit, the time required for drying, etc., and gives practical directions for drying peaches, pears, cherries, prunes, etc. The sun drying of fruits, the preparation of evaporated and dried fruits for market, are dealt with and the laws relating to evaporated and dried fruits in force in the United States are considered.

**1405 - The Installation and Equipment of an Egg-Breaking Plant.** — See No. 1421 of this *Review*.

## 1406 - Review of Patents.

TILLAGE MACHINE AND IMPLEMENTS. — *Italy*: 159733 Universal plough with self regulator; 161069. VITALE motor balance-plough.

*New Zealand*: 39696-39825 Raising, lowering and depth regulating device for ploughs.

*Switzerland*: 79134 Soil tillage apparatus.

*United States*: 1273801-1274586-1274866 Harrows; 1273829 Attachment for ploughs; 1274075 Draft wheel connection for wheel and gang ploughs; 1274876 Stalk chopping machine; 1275209 Plough; 1275588-1276017 Cultivators; 1276051 Vineyard plough; 1276334 Combination plough and pulveriser; 1276645 Harrow tooth.

DRAINAGE AND IRRIGATION. — *Canada*: 184106 Excavator.

*Italy*: 160124 Self acting water lifter for drainage, irrigation, etc.

*Sweden*: 43482 Ditching machine.

MANURES AND MANURE DISTRIBUTORS. — *Italy*: 161557 Physiologically complete mineral manure of natural plant salts for directly fertilising all agricultural seeds and plants

*Sweden*: 43481 Manure spreader device.

*United Kingdom*: 117958 Combined manure and seed distributor; 118225 Machine for sowing seeds.

*United States*: 1274343 Fertilising method and material; 1275332 Fertiliser distributing mechanism; 1275683 Manure distributor; 1275736 Fertiliser chemical and composite distributor; 1276047 Feed regulator for fertiliser sowers.

DRILLS AND SEEDING MACHINES. — *Canada*: 184285 Land marker; 184533 Potato sowing machine.

*Sweden*: 43480 Potato planting machine.

*United Kingdom*: 117938 Potato planter; 117958 Combined manure and seed distributor; 118225 Machine for sowing seeds.

*United States*: 1274062 Three row maize planter; 1274239 Maize planter; 1274447-1274885 Planters; 1276588 Peanut planter; 1276646 Potato planter.

VARIOUS CULTURAL OPERATIONS. — *Italy*: 153315 PAVONE hoe; 160735 Tree straightener.

*Sweden*: 43483 Combined weeder and rake.

*United States*: 1274527 Mulch for sugar cane and the like; 1274718 Cotton chopper; 1275356 Maize cultivator.

CONTROL OF DISEASES AND PESTS OF PLANTS. — *Switzerland*: 79136 Motor sprayer; 79285 Rat trap.

*United States*: 1274201 Weed puller.

REAPERS, MOWERS AND OTHER HARVESTING MACHINES. — *Canada*: 184076 Flax harvester, 184532 Stooking mechanism; 184723 Grain binder mechanism.

*Sweden*: 43450 Mower device.

*Switzerland*: 79135 Basket attachment for mower.

*United Kingdom*: 118255 Fork for swath turning or potato digging machine.

*United States* : 1273814 Cotton harvester ; 1274432-1275551 Maize picking and husking machines ; 1275062 Cutter bar mechanism ; 1275599 Mowing machine ; 1275689 Platform latch for reapers ; 1276064 Transporting vehicle for grain shocks ; 1276295 Non clogging maize harvester knife ; 1276324 Maize cutter.

MACHINES FOR LIFTING ROOT CROPS. — *Sweden* : 43652-43683 Potato diggers.

*United Kingdom* : 117950 Machine for gathering, topping and cleaning root crops which have been dug either by hand or machine and laid in rows on the ground ; 118255 Fork for swath turning or potato digging machines.

*United States* : 1276441 Potato digger.

THRESHING AND WINNOWER MACHINES. — *Canada* : 184085 Potato separator.

*Netherlands* : 2554 Grain cleaning machine.

*Sweden* : 43391 Device for self cleaning thresher ; 43580 Threshing machine.

*United States* : 1274085 Potato sorter ; 1274881 Pea huller.

MACHINES AND IMPLEMENTS FOR THE PREPARATION AND STORAGE OF GRAIN FODDER, ETC. — *Canada* : 184070 Grain pickling device ; 184272 Bag holder.

*Sweden* : 43536-43685 Rack for drying grain and forage.

*United States* : 1273975 Hay cutter ; 1274180 Grain treating machine ; 1274541 Hay carrier ; 1274682 Baling press ; 1274849 Drier for seed maize ; 1275722 Hay loader ; 1276044 Cotton seed drier ; 1276190 Ensilage spreader and packer ; 1276205-1276295 Maize stalk rake ; 1276355 Cotton seed linter.

FORESTRY. — *Canada* : 184810 Tree sawing machine ; 184837 Rotary wood cutting machine.

*United Kingdom* : 117882 Cross cut saw for felling standing trees.

*United States* : 1276140 Stump burner.

STEERING AND TRACTION OF AGRICULTURAL MACHINERY. — *Canada* : 184163 Wagon tongue mechanism ; 184537 Traction belt.

*Sweden* : 43393 Driving wheel for motor plough and tractor.

*Switzerland* : 79133 Tractor for agricultural machine.

*United States* : 1274089 Draft equaliser ; 1274473 Mechanical tractor for agricultural purposes ; 1274574-1274968-1276035 Tractor attachments ; 1274588 Hydraulic motor ; 1275071 Extension steering device for tractors ; 1275343 Tractor frame ; 1275344 Track laying tractor ; 1275600 Tractor ; 1275761 Tractor hitch ; 1276515 Tractor wheel.

FEEDING AND HOUSING LIVESTOCK. — *Canada* : 184203 Animal releasing device ; 184499 Hog feeding machine.

*Italy* : 159905 Simultaneous releasing device for stables.

*United States* : 1274483 Horse shoe ; 1275144 Combination hog trough ; 1276449 Cattle stanchion.

POULTRY FARMING. — *United Kingdom* : 117890 Hand appliance for cutting up food for poultry.

*United States* : 1274104 Device to prevent hens from setting ; 1274166 Incubator ; 1276543 Incubator regulator.

FISHING. — *Canada* : 184451 Gill net sinker ; 184981 Fishing hook.

INDUSTRIES DEPENDING ON PLANT PRODUCTS. — *Canada* : 184191 Grain milling machine

*Italy* : 155198 New system of extracting sugar from sugar beet and other plants ; 159323 Apparatus for the rational germination of grains and cereals ; 159501 Citrus essence extractor with articulated combs working under water ; 159733 New wine-making process ; 159817 CARA oil and fermentation residue press ; 159915 Scutching machine ; 160033 Machine for the preparation, trituration, subdivision, multiple division and working of germinated wheat, or other cereal, vitalised, fermented or treated in any other way so as to soften it ; 160115 Worker for germinated cereals.

*Switzerland* : 79173 Bolting machine.

*United States* : 1273974 1274803 Nut cracking machines ; 1274704 Bread making machine.

DAIRYING. — *Canada* : 184277 Milk pail.

*New Zealand* : 39946 Milking machine pulsator ; 40103 Milking machine teat cup.

*Sweden* : 43317 Centrifugal separator driven by a petrol motor fixed underneath ; 43392 Separator drive mechanism ; 43427 Rotary churn with removable inside wing ; 43452 Device for vacuum milking machine ; 43577 Bowl device for rotary churn ; 43610 Device for heating milk before being fed into a separator driven by petrol motor.

*Switzerland* : 79332 Churn.

*United States* : 1273916 Cream separator ; 1274393 Combined churn and butterworker ; 1274748 Process of treating milk by heating to about 140°F. and cooling to about 40°F without removing from the same vessel ; 1274750 Process of treating milk and the like by sterilisation ; 1276184 Milking machine.

FARM BUILDINGS. — *Canada* : 184203 Animal releasing device.

*Italy* : 159905 Simultaneous releasing device for stables.

*United States* : 1274727 Horse shoeing stand ; 1275148 Silo ; 1276449 Cattle stanchion.

VARIOUS. — *Canada* : 184169-184701-184772 Pumps.

*Italy* : 160978 Improvements to rotary pump.

*United States* : 1273913 Centrifugal pump.

## AGRICULTURAL INDUSTRIES.

1407 — On De-foxing Wines. — RAVAZ, I., in *Le Progres agricole et viticole*, "Est-Centre" edition, Year XXXIX, No. 37, pp. 241-246. Villefranche, Rhone, September 15, 1918.

The author, looking back on the methods for de-foxing proposed in his journal (1), suggests that, in all these processes, oxidation probably plays the most important part. If this is so, on treating foxy or musky

(1) See R., May, 196, No. 555, Feb., 1917, No. 183 and June, 1918, No. 684. (Ed.)

musts or wines by an oxidising agent, the undesirable taste ought to be removed. Experiments made by the author have shown this to be the case.

There are many oxidising agents. The best results have been obtained with manganous acetate and potassium permanganate; but their use is not allowed in wine-making. Hydrogen peroxide, which adds nothing to the vintage that is not already present and leaves no trace behind, is still more active. At the strength of 10-11 volumes, used at the rate of 1 litre per hectolitre, in less than one hour all trace of a foxy or musky taste has been removed from the wine or must. The same result is obtained whether must or made wine be treated. If the dose is stronger, the action is also more rapid, but the oxidation is carried still further and wines are obtained that are aged by several months or even years.

In the grapes, musts and wines, there are natural oxidising agents. In particular there is a diastase which the author was the first to report in wine and which, especially in Grenache, greatly helps to turn an almost yellow shade and causes the bouquet to disappear. If sulphurous acid is used in winemaking, it should only be used after defoxing in order to limit the action of the diastase.

The same oxidase is produced in the grape by the fungus *Botrytis cinerea*, which causes grey mould.

Some day this oxidase may be obtainable commercially.

By making wine according to these directions a more or less marked "casse" will be produced in the wine, but its effects can always be controlled.

**1408—On a Water Bacterium Living in Bitter Wines that can Dehydrate Glycerine; Glycero-Reaction.** — VOISENET, E., in the *Annales de l'Institut Pasteur*, Vol. XXXII, No. 10, pp. 476-510. Paris, October, 1918.

The author has found the presence in water (1) of a ferment having properties similar to those of a bacterium living in bitter wines, which he had previously isolated and studied (2). Each of these organisms can dehydrate glycerine, changing it to acroleine. The author has studied these two bacteria, and has extended the work to cover other bacteria that may be found in water, such as *B. coli*, *B. typhus* and *B. para-typhus*.

The general morphological, biological, cultural and biochemical characters of the bacterium isolated from water, on comparison with those of the bacterium from bitter wine, show a close resemblance between the two organisms. Each organism, on inoculation into a suitable vinous medium, can produce the "bitter disease" of wine with all its organoleptic, microscopic and chemical properties, especially by forming, at the expense of the glycerine, acrylic aldehyde, a substance found by the author to be formed in all wines whether new or old, affected with true bitter disease.

Both organisms seem to belong to one and the same species which, from its habitat, its physiological function regarding glycerine and its pathological function in wine, the author has named *Bacillus amacrylus*, As the

(1) *Annales de l'Institut Pasteur*, Vol. XXVIII, p. 807, 1914. (Author.)

(2) See R., July, 1913, No. 871. (Ed.)

water bacterium constitutes the type species, that of bitter wine can be considered as the same species, with its hereditary qualities simply modified by the necessary adaption to its new food environment, or at any rate as a variety.

This work shows how the introduction of water into wine, which cannot be avoided in practice, whether during vinification or bottling, causes infection with the germ of the disease.

This water bacterium shows analogies and differences with *B. coli* and the typhus and paratyphus bacilli. Like them it grows in phenol broth at 1 % at 42° C. From its character as a lactic ferment, by its action on media coloured with litmus or neutral red, or colourless like the rosaniline medium of ENDO, it resembles ESCHERISCH's bacillus and differs from that of EBERTH and even the paratyphic one. The absence of indol-production would produce an inverse result in comparison, if it were not known that the types of colibacilli, of the variety *anindolicus*, can form that substance.

Two fundamental properties, the one biological, the other chemical, differentiate this organism from those compared with it by the author and which are, at any rate one of them of too common occurrence in water : — it is not pathogenic and it causes the acrylic fermentation of glycerine.

Using the property possessed by *B. amacrylus* of fermentating glycerine with the production of acrolein as a basis, the author describes a special reaction which he calls the "glycero-reaction", which enables this bacterium to be distinguished from the other above mentioned bacteria in water analysis.

1409 - Sudan Dura as a Brewing Material. — BRIANT, I. and HARMAN, H., in the *Journal of the Institute of Brewing*, Vol. XXIV (Vol. XV, New Series), No. 5, pp. 200-214. London, June, 1918.

In 1916 the Imperial Institute sent the authors samples of Sudan dura, with a request for their opinion as to its use for brewing purposes. The first experiments led the authors to conclude that, in spite of its high percentage of fat, dura might prove of value in brewing, especially in view of the present shortage of grain. In May, 1917, having obtained 5 to 6 tons of dura, the authors investigated the possibility of using it as 1) malt, 2) roasted grain, 3) flaked grain, 4) glucose, with the following results : —

MALT. — The dura is not easy to handle during germination; the acrospire, having no protective skin as in barley, is exposed and easily injured and detached during the frequent movement of the grain. Analyses showed a good development of enzymic activity as represented by the diastatic power (24° LINTNER as opposed to 30° for barley malt), and the results are similar to those for barley malt, except in the case of the extract, which is very scarce.

ROASTED GRAIN. — Experiments were made with malted and unmalted grain. The products were satisfactory in aroma and flavour and compared favourably with the products obtained from barley. The roasted grain was tested by London brewers for the manufacture of porter. The porter brewed with dura was better in colour than that brewed with roasted barley although a smaller proportion was used. Experts judged the flavour of the

first in no way inferior to that of the second. It was found possible to substitute dura for barley in the proportion of 7 of dura to 10 of barley without changing the character of the beer.

Two tests in the making of amber malt showed the flavour to be excellent, but the extract yield was low as a result of difficulty in malting. Could this difficulty be overcome it should prove possible to obtain a satisfactory extract.

**FLAKES.** — The flaking process is easily carried out and the starch gelatinises without difficulty. The yield in dura flakes was approximately 80 %, as compared with about 68 % for maize and 95 % for rice. Sufficient flakes were obtained to make comparative brewing tests in which half the usual proportion of flaked maize (15 %) was replaced by flaked dura. The results were satisfactory and brewing experts judged dura flakes to be equal to maize flakes. The author considers dura flakes perfectly suitable not only for brewing purposes, but also as a food for human consumption.

**GLUCOSE.** — Satisfactory preliminary results having been obtained, about 2 tons of dura were used for making glucose which was used in part for brewing. The sugar obtained was of the malto-dextrin type. The beers made were carefully examined. It was found that in new bitter beers decidedly better results were obtained with dura sugar than with invert sugar, but that in new mild ales dura sugar gave rather less fulness than invert sugar, but that in new mild ales dura sugar gave rather less fulness than invert sugar. The beers were again examined after 3 or 4 week's storage. The beers made with dura sugar were of better quality than those made with invert sugar.

The authors consider that if sufficient dura can be obtained at reasonable prices it may be used successfully as a substitute for roasted barley in the manufacture of flakes and sugar of the malto-dextrin type. Several tables of quantitative analyses are given.

**1410 — The Potato Starch Industry in Italy.** — GARELLI, F., in *Le Industrie Italiane Illustrate*, Year 1, No. 8, pp. 45-48. Milan, August, 1917.

The first potato starch factory was founded at Milan in 1885. This, facing great difficulties and owing to initial errors (foreign competition; insufficient protection of 2 lire per quintal; establishment in a large town distant from the large potato-producing centres; absence of sufficient experience in growing big yielding varieties) was obliged to suspend work. In 1900-1901, three starch factories were founded at Rovigo, Bologna and Ferrara, after the agricultural, and most important, side of the question had been thoroughly studied to assure success. After two seasons, the Bologna (the largest) works and that at Ferrara had to close down. At the end of the last century, a small works was installed at Polonghera (province of Turin) as the result of propaganda carried out by Prof. A. GARELLI of Turin University in favour of growing the industrial potato. As the district was unsuited to the industrial crop, the competition due to other better known and more paying crops led to its being abandoned.

It was owing to the success of the sugar-beet crop, that industrial potato growing was attempted in 1900-1901. Everything seemed favour-

able to the new industry, the cotton spinners alone imported 150'000 quintals of starch for finishing, of a value of 4 to 5 million *lire*; the sale price, including an import duty of 2 *lire*, varied between 30 and 32 *lires* \*the quintal. On the other hand the yield per hectare was 270 to 300 quintals for well prepared crops, thus assuring a satisfactory price of 3.5 to 4 *lire* per quintal.

The plant required for a starch factory is relatively simple; one-tenth of the capital required for a sugar factory suffices for a starch factory, which moreover, requires much less fuel.

A small works with 100 hectares of land available can work 200 to 300 quintals of potatoes per day for a season of 3 months, producing 50 to 60 quintals of starch per day or 5 000 to 6 000 quintals during the season. The Rovigo factory can deal with 500 quintals a day. From 15 to 20 starch factories, both large and small, and 3 000 hectares of land devoted to potato-growing would suffice for Italian needs. The Italian starch products are appreciated; and the reason for the failure of the industry to develop is especially foreign competition, the foreign product being sold at 23-24 *lires*, including the import duty. The starch factory could not reduce its prices without reducing the buying price of the potato. In 1911 there were 663 factories in Germany, including 441 agricultural starch factories.

According to the Bulletin of the Italian Ministry of Finance, the imports of European starch were: —

Years	Quintals imported	Average price in <i>lires</i> per quintal	Total value in <i>lires</i>
1909. . . . .	169 556	32	5 425 792
1910. . . . .	158 459	32	5 070 688
1911. . . . .	145 709	37	5 391 233
1912. . . . .	151 221	34	5 141 514
1913. . . . .	161 949	30	4 858 470

In these figures arrow-root and sago flours are not included. The starch from tropical plants is listed in the tariff as exotic starch; in 1913, 79 619 quintals of a value of 2 627 427 *lires* were imported. The total imports of starch thus represent a value of about 8 million *lires* annually.

At present only one starch factory — that at Rovigo — is working in Italy.

1411 — **War Syrups.** — DELLE, E., in *Le Moniteur Vicole*, Year LXIII, No. 41, p. 162. Paris, October 8, 1918.

It is absolutely prohibited to add saccharine to syrups (to the contrary of liqueurs, to which saccharine can be added freely) in France. As sugar is very scarce and glucose being both very scarce and very dear, syrup makers are very embarrassed. All that remains is honey and naturally-sweet fruits (figs, dates, etc.) which are only available in small quantities and that



at high prices. The makers have the alternative of preparing liquids without sugar, but of syrupy consistency, which they could not sell under the name of syrups, but which could replace them if the consumer himself would add a little saccharine to his drink.

To obtain the required syrupy consistency recourse may be had to plants containing mucilaginous matters of agreeable taste, or at any rate insipid and improved by adding suitable perfumes. Anything that might produce undesirable clots must, of course, be rejected. Gum arabic is excellent for this purpose, especially if good material is used; in fact some qualities give solutions which are clarified with difficulty, and any muddy syrup cannot be sold unless by its nature it is really opalescent.

On account of this year's fine grape harvest in France, the preparation of grape syrup is advised. It would be dear on account of the high price of wine, but it is an excellent product which, though long abandoned, is well worth reviving. It is made by heating vintage must, then skimming; chalk is added to neutralise the acidity somewhat; the liquid is filtered, and boiled vigorously until it weighs 32° Baumé. The product is kept in well-corked bottles in the dark in a dry place.

**1412 - Commercial and Domestic Fruit Drying.** — See No. 1404 of this *Review*.

**1413 - Opium Wax.** — JITENDRA NATH RAKSHIT, in *The Analyst*, Vol. XLIII, No. 510, pp. 321-322. London, September, 1918.

Wax is best extracted from opium by means of cold petroleum ether at the rate of 800 cc. of petroleum ether to 200 gm. of dry powdered opium. The ether is decanted off and the extraction repeated for 3 more days with 700, 600 and 500 cc. petroleum ether successively. The extracts are united, shaken with hydrochloric acid and then with anhydrous sodium carbonate. The solution is filtered and evaporated, giving 14.35 gm. of a brown, sticky mass having an odour somewhat resembling cod-liver oil. This opium wax gave the following results: — Iodine value, 152.5; Reichert value, 2.0; saponification value, 114.5.

**1414 - Acetic Acid Manufacture on Rubber Estates.** — KEUCHENIUS, P. E. (*Besockish Proefstation*), in *Archief voor de Rubbercultuur in Nederlandsche-Indië*, Vol. I, No. 5, p. 413-417 + 1 Fig. Batavia, 1917.

Owing to the continually increasing market prices of acetic acid, an attempt was made to produce acetic acid according to an old method and find out whether the acid obtained in this way would really be cheaper and whether rubber coagulated with this acid would be not inferior to rubber coagulated with imported acetic acid. Investigations by the Buitenzorg Central Rubber Station have proved that these questions are to be answered in the affirmative.

The method mentioned is very simple and is founded on the fermentation of alcohol to acetic acid. The whole installation required for this purpose consists of a wooden cask.

Taking into consideration the price paid now for alcohol, the acetic acid obtained through fermentation of alcohol will cost about 1s. 10d. per lb. Should it be possible to use methylated spirit, then the acetic acid would

cost about 3d. per lb. This acid, however, is of a low percentage concentration which can be easily ascertained by titration.

1415 - **Mechanical Coagulation of Rubber.** — ZUYDERHOFF, G. J., in *De Indische Mercur*, Vol. LXXI, No. 32, pp. 620-621. Amsterdam, 1918.

The author first reviews the best known methods for coagulating rubber, shows their respective advantages and disadvantages, and then describes the new method of coagulating by heat, together with the results it has given on testing it. The present high price of acetic acid and the hope of obtaining a product with better qualities lead the author to carry out the following experiments:—

The recipients usually used for coagulation are heated moderately from below while a current of ordinary or dry air is passed above. Another way consists in passing a current of warm air above the recipients containing the latex. To prevent the formation of a skin that would hinder the action of the air on the deeper layers of the latex, the author advises stirring the mass, or better still, keeping the recipients slightly agitated. The mass, when once well taken, is left and finally crêped. The colour of the crêpe thus obtained is quite light although in the first tests it varied greatly in each sample. The quality of the product seems quite comparable with that of samples obtained by chemical coagulation. The author insists on the economic side of the method, which, by this fact alone, is of interest and worth perfecting through further researches.

1416 - **The Utilisation of Coal Dust for Heating Greenhouses.** — RIVOIRE, P., in the *Revue Horticole*, Year XC, No. 9, pp. 157-158. Paris, September 16, 1918.

In order to utilise coal dust, M. REVERCHON, horticulturist of Moulin-à-vent, near Lyons, France, devised a method of consolidating it with lime, as tar cannot be obtained at present. He made bricks, using an iron mould such as that used by masons for making flag-stones. The mould is composed of two flat, elbowed irons, joined at the edges by clamps. The mould is placed on a piece of sheet iron with two handles, which enables it to be carried. The bricks are made with 5 kg. of lime, 20 litres of water and 100 kg. of coal.

The lump quicklime (now sold at Lyons at 11s. 10d. per hectolitre weighing 158 to 165 lb.) must be slacked one or two days before use with an equal quantity of water. When making the bricks the lime is put in a wooden tub together with the required amount of water and mixed vigorously with a trowel. The coal is placed on the ground near at hand. A hole is made in 100 lb. of the dust and the contents of the lime poured into it in two or three times. The mixture is stirred with a shovel to mix it well and distribute the moisture equally. The mould is then filled with the mixture by means of a trowel and the contents pressed down. The slight hollow formed is filled up, the whole re-pressed, and levelled with a trowel. The bricks are taken from the mould by removing the clamps and dried in the shade for about a week. If they are dried too rapidly in the sun the mixture remains powdery and the bricks break up too easily. The bricks weigh 11 to 13 lb., so that 100 lb. of coal will make 9 bricks. With a little practice 22 bricks an hour may be made.

To test the use of the bricks a fire was lit in a greenhouse furnace. Although little wood was used the bricks took fire easily. They ignited gradually and gave out a great heat although they were made with very bad coal. It is difficult to understand the part played by the lime, though it seems to act as a cement.

In view of the shortage of fuel this method is very valuable. It would also be of great service to horticulturists by allowing them to use dust of bad quality coal for heating their greenhouses.

1417 - **The Refractometric Estimation of Milk Sugar.** — PANCHEAUD, L. and AUERBACH, E. (Cantonal Laboratory, Geneva), in *Travaux de Chimie alimentaire et d'Hygiène*, Vol. IX, Pt. 5, pp. 236-239 + 3 Tables. Berne, 1918.

INDUSTRIES  
DEPENDING  
ON ANIMAL  
PRODUCTS

Communication to the 30th General Meeting (1918) of the Swiss Society of Chemists and Analysts.

The refractometric estimation of the lactose in cow's milk, started by WOLLNY (who used a calcium chloride serum and a special milk refractometer) has made little progress. But ACKERMANN, using his chlorocalcic serum and the ZEISS immersion refractometer, has shown that WOLLNY's tables could, with some slight modifications, be adapted to the graduation of the immersion refractometer (*Mitteil. Lebensmitteluntersuchung und Hygiene*, Vol. VII, p. 319. Berne, 1916). GABATHULER has drawn attention to the importance and value of lactose for valuing milk from a hygienic standpoint; in fact a clear decrease in the lactose is seen in sick animals, especially if they are suffering from diseases of the udder (*Zeitschrift für Fleisch und Milchhygiene*, 1915, Vol. XXV, p. 97). Since then the method has become very interesting. In order to ascertain the final difference between the lactose content estimated refractometrically and that obtained gravimetrically, the authors have tested a large number of milks of different origin and varying freshness (normal or watered fresh milks, sour milks, abnormal milks from sick cows) by means of the ACKERMANN method for the refractometric estimation and the ALLHYN method for the gravimetric estimation. The results, given in table form, lead to the following conclusions: —

1) *For fresh, normal or watered milks*, there is a remarkable concordance between the refractometric and gravimetric results.

2) *For sour milks*, the refractometric method gives results that are too high (one part of lactose, changed into lactic acid of a high refractive power, and one part of albuminoids coming into solution, are no longer precipitated by the calcium chloride).

3) *For abnormal milk from sick animals*, the refractometer figure is too high, owing to the increase in the chlorides and changes in the albumins and casein due to the pathological condition.

1418 - **Free Lactic Acid in Sour Milk (1).** — VAN SLYKE, L. L. and BAKER, J. C. (Chemical Laboratory of the New York Agricultural Experiment Station, Geneva), in *The Journal of Biological Chemistry*, Vol. XXXV, No. 1, pp. 147-178 + 12 Tables. Baltimore, July, 1918.

When speaking of the acid constituents of sour milk, the lactic acid is understood, as if the acidity were due directly and entirely to the presence

(1) See the summary of a previous paper by these writers, in *R. May*, 1918, No. 576. (*Ed.*)

of free lactic acid as such. When milk sours under ordinary conditions, lactic acid is first formed, but this reacts at once, practically as fast as formed, with the basic constituents present in the milk. In fresh cow's milk, the compounds reacting with acids are, first, basic phosphates and citrates of calcium, magnesium, sodium and potassium, and, second, calcium caseinate. When the lactic acid of sour milk reacts with these compounds numerous salts are formed, the essential results of the reactions being monocalcium phosphate, free casein and calcium lactate. In view of this there will not be much free lactic acid in souring milk until these reactions are practically completed.

The authors have used three methods for determining the amount of lactic acid in sour milk: — 1) measurement of hydrogen ion concentration and application of the mass law; 2) double electrometric titration with lactic acid and hydrochloric acid; 3) partial extraction by ether; the technique of each of these methods is described in detail. They further carried out experiments on the influence of the adsorption of lactic acid by the casein and studied the effect of certain factors on the free lactic acid content and on the coagulation point of the casein in sour milk.

RESULTS. — 1) In sour milk most of the lactic acid is present as lactate. Part of the free acid is in solution while a smaller part is adsorbed by the casein. A Freshly separated skim-milk, pasteurised at 62°C., cooled to 25°C., and inoculated with *Bacterium lactis acidii* showed no appreciable quantities of free lactic acid until 20 hours after inoculation (there were then 0.1 cc of acid in 0.1/N solution in 100 cc. of milk; this amount then increases fairly rapidly, amounting to 20 cc. after 48 hours)

2) In milk soured at 25° C after undergoing various treatments (pasteurised milk inoculated with *B. lactis acidii* or *Bacillus bulgaricus* or *Streptococcus lacticus*; inoculated unpasteurised milk; etc.) the total acidity varies from 70.5 to 220 cc. of 0.1/N acid per 100 cc. of milk; the free lactic acid from 8.6 to 124 cc.; the acid as lactate from 51.8 to 92 cc.; the hydrogen-ion concentration from 3.70 to 4.56. In milk soured under ordinary conditions, the total acidity varies from 70.5 to 107.5 cc.; the free lactic acid from 13.1 to 34.5 cc.; the hydrogen-ion concentration from 4.02 to 4.43.

3) About 20 % of the free lactic acid is absorbed by the casein in coagulated sour milk and the milk casein begins to coagulate when the hydrogen-ion concentration reaches 4.64 to 4.78. The time from beginning to end of coagulation varies from 30 to 60 minutes, during which time the hydrogen-ion concentration remains constant.

4) The first physically and easily perceptible sign of souring in milk is a characteristic smell and taste, due to the presence of some volatile compound formed in the souring process and not to lactic acid.

There is no apparent relation between either the hydrogen ion concentration or the acidity by titration and the first sign of this flavour.

1419 — "Renovated" Butter. — *Revue Scientifique*, Year LVI, No. 16, p. 504. Paris August 17-24, 1918.

Whilst increasing the quantity of food stuffs they produce the United States are also attempting to improve the quality and increase the

commercial value. M. G. D'AVENEL gives a significant example of this. Instead of heavily salting their summer butter, the amount of which exceeds the demand, and which is usually mediocre butter not easy to sell, the American farmer has devised what was first called "magic butter", then "boiled" or "sterilised" butter, and which is now known officially as "renovated butter".

The butter is melted as soon as bought on the market by the 80 firms that use the method, then solidified in iced water after 1 % of glycerine and 5 % of salt have been added, then preserved in closed recipients until winter. To return it, according to the demand, to its original state, the salt and glycerine are carefully extracted by again melting it; it is mixed with 3 times its volume of milk, and the emulsion of butter and milk obtained in this way exactly resembles fresh cream, which is then churned in the usual way. "Renovated butter" is quite pure, since it contains no foreign matter, and, although it is required by law to be labeled "renovated butter", it is nevertheless much in demand on account of its price, more modest than that of choice varieties.

**1420 - The Manufacture of Casein from Buttermilk or Skin Milk.** — DAHLBERG, A. O., in the *United States Department of Agriculture Bulletin* No. 661, pp. 32 + 9 Figs. + 6 Tables. Washington, April 9, 1918.

The utilisation of by-products by a large number of creameries is daily becoming of more economic importance. Because of the ever-increasing competition, the future success of many creameries depends in no small degree upon both the quality of their products and the extent to which by-products may be profitably utilised.

In the past skim-milk casein is the only kind that has been made in large quantities; a good grade of casein can also be profitably made from buttermilk, when it does not bring exceptional prices for food. It is advisable to convert the buttermilk into food products when proper markets can be obtained, as greater profits can then be obtained. But as it is not always possible to utilise all the buttermilk in this way, it is important to be able to turn the surplus into casein, which keeps perfectly and finds a ready market.

**BUTTERMILK CASEIN.** — The recovery of casein from buttermilk by the method to be outlined depends on the normal acidity of the buttermilk. The sour buttermilk from the churn, or that which has ripened to the required acidity, is heated sufficiently to cause a rapid separation of the curd and whey. Owing to the fineness of buttermilk curd every precaution must be taken to prevent it from being broken up any finer, which makes handling more difficult. Turning steam directly into the butter tends to break the curd up. The method devised for suitably heating the buttermilk is to run it through a steam jet or ejector, which gives the desired temperature in a rapid and efficient manner and with very little agitation of the curd. With buttermilk of sufficient acidity a good separation should be obtained at a temperature varying between 115° and 130° F (46.11° and 54.44° C). This method is based on results obtained in devising a method for handling

surplus buttermilk at the Grove City Creamery, Pa., operated under the supervision of the Dairy Division, U. S. Dept. of Agriculture. The method has been thoroughly tried in a commercial creamery, where it is giving most satisfactory results.

*Precipitating the curd.* The buttermilk from the churn is pumped into a tank elevated sufficiently to allow it to run by gravity through an ejector and from there into another tank below, whose gate valve is high enough to let the drain rack run under it. To save time, the heating should be done quickly. A valve placed in the buttermilk pipe leading from the tank to the ejector, and one in the steam pipe next to the ejector, permit easy control of the temperature to which the buttermilk must be heated to obtain proper separation. While conclusive data bearing on the acidity required for the most favourable results have not been obtained, an acidity of from 0.65 to 0.80% at the time of precipitation apparently gives the best working conditions. Buttermilk kept too long and highly acid tends to give a soft, sticky curd difficult to handle, especially when a high precipitating temperature is used. By varying the temperature used the proper degree of heat necessary to get good results may be obtained. At that temperature the buttermilk coming from the ejector is in such a condition that the curd rises quickly to the top, leaving the clear whey below. As soon as the curd has massed at the surface, which requires only a few minutes, the greater portion of the whey can be drawn from the bottom of the vat into the cloth-lined drain rack. The clear whey passes through the drain cloth quickly and by gradually closing the gate valve as the curd lowers in the vat, nearly all of it can be drained away. When the whey has drained away, the hot curd is placed on the drain racks ready for washing. The curd is washed at least twice with cold water, using a shower-bath spray nozzle. The drainage water should test less than 0.20% acidity, which is possible with two washings. The curd is placed in a form made of 1 inch surfaced material 20 in. square and 8 in. deep which is lined with 2 press cloths; the cloths are turned over from both sides so as to hold the curd securely when pressure is applied. The curd is pressed heavily until the curd is sufficiently dry for satisfactory grinding. The dry curd is ground finely, then dried. Fine-mesh screening must be used for the drying trays, as the buttermilk casein is very fine, not flaky like that made from skim milk by the addition of commercial acid. The curd is then spread uniformly over the drying trays by means of a simple shaker screen, like those used for screening sand.

The time required for proper drying depends on the condition of the curd, the uniformity of the spreading on the trays, and the volume and temperature of the air passing over the curd. The volume and speed of the air blowing over the curd should not be excessive, but sufficient to carry off the moisture readily. If the air current is too swift the dried casein is blown off the trays. A temperature of 130° F (54.44°C) is sufficiently high for all purposes. Casein dried at that temperature comes from the drier in a fine-grained condition and breaks up easily, while that dried at a higher temperature tends more to cake in one mass and is harder to grind to the same

degree of fineness. High temperatures may give casein that is more difficult to dissolve or discoloured. The casein can be dried completely at 103° F., provided that the curd has been properly ground and spread upon the trays in the proper manner.

The best type of drier is made of tongue-and-groove boards nailed both sides of the studding, the space between being filled with insulating material. The tunnels should be lined with galvanised iron if they are to be used continuously as the hot air dries the boards out. The double tunnel drier is the most economical. The tunnel should be 1 inch wider than the trucks and drying trays. Many tunnels are made 31 or 32 inches wide to take the 30 in. square drying trays that can be bought ready made. The tunnels used in these experiments were 24 in. wide. A double-tunnel drier, 22 ft. long, 5 ft. high, and each tunnel 24 in. wide will hold trays filled with the casein from 20 000 lb. of buttermilk. The driers can be made of any length and height but should be high enough to allow a man to walk in and out easily when pushing the trays.

A blower of sufficient capacity to send a large volume of heated air over the ground curd is required. Details are given for the construction of the drying trays and trucks, the curd mill, the curd press, the drain rack (like those used in the manufacture of cottage cheese) and other accessories.

It is advisable to grind and screen the casein after it comes from the drying tunnel in order that it may be of uniform grain and appearance; after it is shipped in strong sacks.

On the average 100 lb. of undiluted buttermilk yield on the average from 2.8 to 3.1 lb. of dried casein. In many creameries the cream is diluted with too large a quantity of water before churning, thus giving lower yield of casein.

No definite figures can be given on the cost of manufacturing, as cost-accounting data were not kept that could give results applicable to ordinary creamery conditions. If 10 000 lb. of more of buttermilk are handled daily the cost of making dried casein should not exceed 3 cents per lb. in the U. S.

The factors that have an important influence upon the quality of the buttermilk casein are:—the fat content of buttermilk; washing the precipitated curd; temperature of drying the ground curd; temperature of precipitating the curd; acidity of buttermilk at the time of precipitation. These factors are considered separately. Since the fat originally in the buttermilk is concentrated in the dried casein, it probably has a deleterious effect upon the strength and general working properties of the casein. An increased quantity of fat yields a casein of poorer solubility and strength. The effects of these various factors are shown in a number of tables.

**SKIM-MILK CASEIN.** — This is usually made by adding crude commercial sulphuric acid to the fresh skim milk after heating the latter to a temperature of 120° F. (48.8° C.). The advantage of this method is that the skim milk can be disposed of quickly and at a time when the quality of the curd is in the best condition.

The skim-milk is heated directly by steam in a wooden vat to 120° F., never above 125° F. Commercial sulphuric acid (1.83 specific gravity)

is then added at the rate of one pint to every 1 000 lb. of milk, at the same time stirring the mixture continuously. Before using, each pint of acid should be diluted with about a gallon of water. After adding the acid the skim-milk is stirred gently until the curd is well separated, which takes only a few minutes. If the curd does not separate well more acid may be added. The clear whey is run off and the curd remaining in the vat is rinsed with cold water to remove the excess of whey and acid remaining. The curd is then placed in the burlap or duck press cloths and put to press till sufficiently dry. The curd is then ground, placed on the trays and dried in the tunnel drier.

The cooked-curd method of making skim-milk casein, requiring practically no equipment save the precipitating vat, is coming into general use among creameries near to a central drying plant. The skim-milk is heated to 120° F. and sulphuric acid added to coagulate the casein, as described above. After draining off the whey the curd is broken up in the vat, covered with water, and the mixture heated to 170°-175° F. (76.67° to 79.44°C.) by means of direct steam. At that temperature all the curd should collect in a semifluid, plastic, tough mass. The water is drained off and the soft curd placed in a barrel, where it settles into an almost air-tight mass which on cooling changes to a very tough impervious mass that will keep for several days, even in hot weather. The barrels filled with cooked curd and covered with burlap can be shipped to the central drying plant. Cooked curd is hard to grind and requires an especially strong mill.

Casein can be made successfully from skim milk with the ejector method of precipitating the curd, but care must be taken in allowing the skim milk to curdle before heating, or a tough, rubbery curd, impossible to handle, will result. The curd from naturally soured skim milk, separated by the ejector method of heating, is not only handled as easily as that precipitated with sulphuric acid but is not nearly so tough nor so hard to grind.

From 100 pounds of average skim-milk between 3 to 3.25 lb. of casein can be obtained.

After describing the requirements for good casein (especially its solubility, adhesiveness, and general working qualities), the author considers the casein markets and prices.

A few years ago casein cost from 5 to 7 cents a pound, but during the last 2 years the price has doubled or more; at one time even 22 cents a pound was offered in the United States.

1421 - **The Installation and Equipment of an Egg-Breaking Plant.** — JENKINS, M. K., in the *U. S. Department of Agriculture, Bulletin No. 663*, 25 pp. + 25 Figs. + 2 Photographs + 2 Tables + Bibliography of 5 Publications. Washington, May 27, 1918.

The aim of this bulletin is to assist manufacturers of preserved liquid eggs to make a judicious choice of apparatus and to instal their plant so as to prepare the preserves hygienically and, at the same time, assure the maximum economy of space and labour. A modern plant of this kind must contain a chilling room for whole eggs, a candling room, a chilled room for breaking the eggs and removing the contents from the shell, a room for wash-



ing and sterilising the utensils used for breaking and separating, and a refrigerating room for the rapid freezing of the liquid eggs and their storage.

A plan shows the arrangement of the different rooms. It provides for a staff of 12 breakers and a daily output of 120 cases if the white and the yolk are separated and of 180 cases if the eggs are preserved whole. A skilled worker may prepare 12 to 15 cases of whole eggs daily and 8 to 10 cases if the white is separated from the yolk. The temperature of the rooms varies according to the purpose for which they are used. The temperature of the chilling room should be from 32 to 40°F., that of the candling room from 50 to 55°, of the breaking room from 60 to 65°, the sterilising room normal and that of the refrigerating room from 0 to 10°F. All the rooms should be suitably insulated. The breaking and sterilisation rooms should receive plenty of natural light from windows. The walls and ceilings of these two rooms should be plastered and white enamelled and the floors concrete with trapped drains. Between the two rooms should be a sliding window for the transfer of equipment. The refrigerating room should be equipped with shelves of piping through which passes the brine for freezing the cans of liquid eggs. The shelves should be 20 in. wide and about 15 in. apart.

The candled eggs are removed to the breaking room in metal pails. Leaking eggs after candling are placed in special square trays (made of galvanised iron with an iron plate perforated to hold 36 eggs; it is 12  $\frac{1}{4}$  in. square and 3  $\frac{1}{2}$  in. high) for removal to the breaking room. The apparatus used in the liquid egg preserving industry must, like that of dairies, be made of material which washes easily and does not rust.

The eggs are broken into glass cups which make it easy to see which eggs should be rejected. The cups should be of thick glass capable of holding two eggs but not more; sometimes only one egg is broken into each cup. The cups are placed on a special metal tray fitted with a detachable knife on which the eggs are broken. The knife rests in slots in standards fastened to the ends of the tray. When the white is separated from the yolk this should be done by a sanitary mechanical device. The tables should be covered with non-absorbing material, such as metal or porcelain. A full list of the requisite apparatus is given in a table; part of it may be bought ready made, but part must be made to order.

Before freezing liquid eggs the whites and the yolks must be mixed in a special churn fitted with a motor-driven paddle. This is one of the most important pieces of apparatus in the breaking room. Two types of churn are at present in use, one chills the eggs to nearly freezing during the churning process, the other simply mixes the eggs. The first type is indispensable in establishments having no adequate refrigeration system for cooling the eggs before breaking and rapidly freezing the liquid eggs. Holding the eggs at a warm temperature, even for a few hours only, causes a rapid multiplication of bacteria. The refrigerating churn most commonly used is a modified pasteurising machine which may be bought from dairy supply firms. Non-refrigerating churns are also described and illustrated by figures. It is essential that the churn be made so that it may be rapidly washed and sterilised. The sterilising room must contain sinks for washing the utensils.

and sterilisers. The sinks must be fitted with mechanical rinsers and drains.

Frozen liquid eggs are usually sold in 30 lb. tins, but sometimes in 20, 10 or 5 lb. tins, especially in the case of the whites of eggs.

AGRICULTURAL  
PRODUCTS;  
PRESERVING,  
PACKING  
TRANSPORT,  
TRADE

1422 - **Microorganisms and Heat Production in Silage Fermentation** (1). — HUNTER, O. W. (Dairy Bacteriologist, Kansas Agricultural Experiment Station), in the *Journal of Agricultural Research*, Vol. X, No. 2, pp. 75-83 + 10 Figs. + Bibliography of 15 Publications. Washington, July 9, 1917.

Different workers disagree as to the cause of heat production in silage. Some consider it to be due to respiration of the tissue cells, others to respiration of tissue cells and microorganisms and others to microorganisms alone. In order to solve this problem the author ensiled maize, alfalfa, sugar cane and kafir under the following conditions: — 1) normal, natural fermenting forage; 2) forage treated with antiseptic; 3) forage treated with heat; 4) forage treated with heat and inoculated with bacteria; 5) dried forage.

Heat production occurred in the untreated and inoculated forage; in the other cases the rise in temperature was due to heat absorption. Dried forage undergoes normal fermentation when water is added. Heat production in silage is, therefore, due to bacterial activity and not to respiration of the tissue cells.

1423 - **The Cork Industry**. — BARRIS, in *Le Chêne-Liège*, Year XXIV, No. 635. Bone (Algeria), September 15, 1918.

Report by the author, Financial Delegate on the Committee of the Councillors for Foreign Trade at the French Ministry of Commerce and the General Government of Algeria, dealing with the general question of Algerian and French corks and its relation to other countries.

**WORLD'S CORK PRODUCTION.** — Cork production is strictly limited to the Western Basin of the Mediterranean and the Atlantic coasts of the Iberian Peninsula and South-West France. Expensive attempts have been made to plant the cork-oak in many places (California, Australia, the Cape, Japan, etc.), but with wholly negative results. Countries having forests of this tree thus enjoy a natural monopoly.

The appended Table shows that Algeria alone furnishes nearly  $\frac{1}{3}$  of the world's production; France, Algeria and Tunis together furnish just over  $\frac{2}{5}$  of that production, without including Morocco, where there are vast forests that will soon be exploited. The cork industry is very little developed in France and it practically does not exist in Algeria.

**WORLD'S CORK MARKETS.** — The greatest consumers of unworked cork, not including France, are: — England, Russia, Germany, Austria-Hungary and the United States. The four last-named countries admit unworked or slab cork duty free and subject worked cork to heavy duties to protect the home industries. England is the only one of these nations that admits both raw and worked cork duty free, but the cork comes mostly from Portugal and Spain.

(1) See also R. July, 1917, No. 650. (Ed.)

*Area and yield of cork-oak forests.*

	Area of cork-oak forests hectares	Yield in cork of these forests quintals
France . . . . .	150 000	120 000
Algeria . . . . .	426 000	419 000
Tunis . . . . .	82 000	50 000
Italy . . . . .	80 000	40 000
Spain . . . . .	250 000	275 000
Portugal . . . . .	300 000	425 000
Morocco . . . . .	note	note
<i>Totals . . .</i>	<b>1 288 000</b>	<b>1 329 000</b>

UNWORKED CORK. — The following countries imported the following amounts (in quintals) of raw cork in 1913: — France, 66 000; Russia, 72 000; Germany, 58 000; Austria-Hungary, 56 000; Belgium, 35 000; Netherlands, 22 000; United States, 55 000; Spain, 30 000; England, 9000; Sweden, 4000; Denmark, 4000; Italy, 2000; Japan, 2000.

The exports of raw slab cork from Algeria into France are sent for to be partly turned into worked products. France re-exports part of the Algerian cork as well as part of the home product in the raw state, while she has to import worked cork, which shows the inferiority of her bottle-stopper industry, although France is the most important market in the world for the worked products, on account of the large amount of wine bottling carried on.

The countries of central Europe, Belgium, the Netherlands and the United States appear to have taken the first place on the Algerian cork market.

The exports of male cork, debris, etc. preponderate in this trade. The exports to Central Europe and America mostly consist of these products, used for making cork powder, agglomerates, now so much used, and linoleum.

On considering market cork only, it is seen that the above-mentioned countries hold a good place, but it will be found that France and Russia absorb  $\frac{2}{3}$  of the good Algerian cork, while the great mass of the by-products and inferior qualities is taken by the Austro-German and American trade which transforms it, reexporting a part after manufacture.

WORKED CORK. — The Algerian exports of worked cork are so far very limited. In 1913 they reached 6500 quintals, and represent the product of about 10 000 quintals of raw cork. About 70 % of these exports goes to France, while the rest goes to Central Europe, especially Austria-Hungary, whose importations through Adriatic ports are gradually increasing.

THE ALGERIAN INDUSTRY. — This is quite rudimentary, only working 10 000 quintals in the best year (1913).

There was a double reason before the war for this state of affairs. On the one hand, the local consumption is small and will only increase

slowly in the future. On the other hand the big cork-consuming and non-producing countries have taken measures to assure that the cork will be transformed into worked products in the importing country by placing light duties on unworked cork and very heavy, if not prohibitive, duties on worked cork (save Great Britain).

The author points out the necessity for France to obtain, after the war, free trade between all countries for worked cork or, at any rate, equality as regards import duties for all corks in all countries.

## PLANT DISEASES

### DISEASES DUE TO FUNGI, BACTERIA AND OTHER LOWER PLANTS.

1424 - **New and Rare British Fungi.** — WAKEFIELD, E.M., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 7, pp. 229-233. London, 1918.

GENERAL

Among the seven species of fungi observed in Great Britain from 1916 to 1918 and recognised as new to science or to the mycological flora of the country, the following deserve special mention: —

1) *Merulius Pinastri* Burt., found in abundance at the Botanical Gardens at Kew in September, 1917; the conditions in the greenhouses are so favourable to its development that at times it becomes almost a pest.

2) *Nectria fusco-purpurea* n. sp., observed at Wisbech in 1917 on dead branches of Pond's Seedling plum trees; there is no evidence that this fungus caused the death of the branches, but it was not found on any other variety of plum.

3) *Cercospora Antirrhini* n. sp., reported from Worcester (September, 1917) and from Birmingham (June, 1918) as damaging *Antirrhinum*, the leaves and stems of which it attacked.

4) *Mastigosporium album* var. *muticum* Sacc., on leaves of *Dactylis glomerata* at Oxshott (October, 1917) and at Kew (1918).

5) *Helminthosporium Warpuriae* n. sp., on an injured stem of *Warpuria clandestina* at Kew in July, 1917; this fungus appears to belong to the class of facultative parasites, having entered the plant through a wound; it grew there parasitically, but probably as a rule it is a saprophyte and would not attack an uninjured plant.

1425 - **Patents for the Control of Diseases and Pests of Plants.** — See No. 1406 of this Review.

MEANS  
OF PREVENTION  
AND CONTROL  
DISEASES  
OF VARIOUS  
CROPS

1426 - **Diseases Reported on Wheat in Java.** — PALM, B., in the *Mededeelingen van het Laboratorium voor Plantenziekten*, No. 34, pp. 1-21 + 12 Figs. + 1 Plate. Batavia, 1918.

In 1918 the Department of Agriculture, Industry and Commerce conducted wheat growing tests in the high and low regions of Java. In the high regions, the results were, as a rule, satisfactory, save for the fact that a more or less large number of wheat plants of different varieties (the tests had been carried out with wheat varieties from Europe and India) was attacked by fungous diseases amongst which *Ustilago Triticici* (Pers.) Rostr. and *Gibberella Saubinetii* (Dur. and Mont.) Sacc. = *Fusarium rostratum* Appel and Wollenw. are of considerable importance. The diseases were probably introduced with wheat grains as they were previously unknown in

[1424-1426]

Java. Since then, *Helminthosporium gramineum* (Rab.) Eriks. (?), *H. geniculatum* Tracy and Earle, and *Nigrospora Panici* Zimm. have been recorded as injurious. The author is as yet unable to say whether the two *Helminthosporium* diseases originated in Java; he is, however, of that opinion, as he has occasionally found both the species on maize. *Nigrospora Panici* has been long known in Java.

1427 - *Uromyces pedicellatus* n. sp., a Rust Injurious to *Eragrostis abessinica* and *E. curvula* in the Transvaal. — POLE EVANS, I. B., in the *Royal Botanic Gardens, Kew, Bulletin of Miscellaneous Information*, No. 7, pp. 228-229 + 1 Fig. London, 1918.

According to observations made by the author at Pretoria, Transvaal, the stems and leaves of *Eragrostis abessinica* Link. (= *Poa abyssinica* Jacq.), locally known as "teff", are very seriously attacked in South Africa by an *Uromyces* which does not appear to have been described hitherto. The leaves and stems of *E. curvula* Nees are also frequently attacked by an *Uromyces* differing slightly from *U. Eragrostidis* Tracy, already described on *E. pectinacea* Nees in North America and on *E. cynosuroides* Beauv. in India. The *Uromyces* on *E. curvula* is identical with that on *E. abessinica* and it seems not improbable that the rust which attacks *E. abessinica* in South Africa has passed on to it from *E. curvula*. The author describes this rust under the name of *U. pedicellatus*.

1428 - *Cronartium occidentale* n. sp., a Rust Injurious to *Pinus edulis*, *P. monophylla*, *Ribes* spp. and *Grossularia* spp. in Colorado and Arizona, U. S. A., — HEDGECOCK, G. G., BETHEL, E. and HUNT, N. R., in the *Journal of Agricultural Research*, Vol. XIV, No. 10, pp. 411-424 + 1 Fig. + 1 Plate. Washington, December 2, 1918.

The authors describe as a species new to science *Cronartium occidentale*, a parasite of *Ribes* spp. and *Grossularia* spp. This rust has been observed in Colorado for many years and also in Arizona and seems to have been found in Kansas on *R. aureum* before being reported from the other two States. By means of cultures it has recently been found possible to grow it on *Ribes* spp. and *Grossularia* spp. even in the Columbia district (Washington).

Repeated inoculation experiments have shown the aecidial stage of this fungus to be represented by a species of *Peridermium*, at present known as *Per. occidentale*, which has so far been found on 42 *Pinus edulis* trees in five different districts of Colorado and on one *P. monophylla* near Prescott, Arizona. These two pines, together with *P. combroides*, which is probably also a host of *Per. occidentale*, and *P. quadrifolia*, are known as "pifion" pines. As this rust has only been observed on the trunks and branches of pifions and, so far as is known, does not attack other pines, it has been called pifion blister rust. In the various districts of Colorado and Arizona in which *Cron. occidentale* has so far been observed the common host of the urediniospores and teliospores is *R. aureum*, although both these forms are sometimes found on *R. odoratum*, *R. inebrians*, *Grossularia reclinata* × *Gr. hirtella* and *Gr. leptantha*.

*Cron. occidentale* was inoculated with positive results into *R. americana*

*num*, *R. aureum*, *R. coloradense*, *R. Giraldi*, *G. glandulosum*, *R. malvaceum*, *R. nigrum*, *R. odoratum*, *R. sanguineum*, *Ribes* sp., *Gr. inermis*, *Gr. missouriensis* and *Gr. reclinata*  $\times$  *Gr. hirtella*.

*Cron. occidentale*, which differs from *Cron. ribicola* in the aecidial stage especially, seems capable of over-wintering on *R. aureum* and remaining independent of the aecidial stage.

*Per. occidentale* is rarely found, at a certain distance above the soil, on very old *P. edulis* trees, and occurs in the crevices of the bark, often without adjacent dead areas. In such case the fungus is hardly discernible, even with a hand lens. Its effects are clearer on young trees, a number of which, apparently killed by the fungus, have been found in South Colorado. They are usually attacked on the trunk and branches near the soil, some becoming spike-topped. Plants of *Ribes* and *Grossularia* attacked by *Cron. occidentale* seem to suffer but slight injury. If the attack is severe partial loss of leaves will result, and repeated attacks may cause stunted growth, but no trees killed by this fungus have been found.

## WEEDS AND PARASITIC FLOWERING PLANTS.

1429 - **Orchid Parasitic on the Leguminous Plant *Caesalpinia coriaria*, in the Dominican Republic.** — See No. 1363 of this *Review*.

1430 - ***Sorghum halepense*, a Weed in Porto Rico.** — STEVENSON, J. A., in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 132-135 + 2 Figs. San Juan, Porto Rico, 1918.

The presence of *Sorghum halepense* (Johnson grass, "yerba de don Carlos" or "canuela") is reported from Porto Rico. The grass has been noted in various places in the neighbourhood of Rio Pedras and is fairly common in the pineapple-growing zone near Vega Baja; it is certainly present in other parts of the island. The weed has begun to spread largely in the pineapple plantations, causing considerable damage.

As regards means for controlling the grass, the first precaution is to avoid bringing it into the fields as a forage crop, because the disadvantages resulting from its great tendency to spread and the difficulty with which it is extirpated once it has taken root are much greater than its value as food for cattle.

If the plant has already spread in a field radical measures must be taken at once; and seed formation must be avoided at all costs. It must be removed by tearing up its rhizomes; after a few weeks the operation should be repeated to destroy the plants produced by the pieces of rhizome remaining after the first removal.

When the plant has already taken possession of a considerable area the rhizomes will have to be removed for some years in succession; but the author thinks there will be no need for such an extreme measure at Porto Rico. In this case, however, the plant should be kept level with the soil by using the ground two or three years in succession for the production of cut forage. Then, after a light ploughing, some crop should be grown that

requires the use of a cultivator. With a little more effort, by extirpating the plants of *S. halepense* as they emerge from the ground, the work will be crowned with complete success.

## INJURIOUS INSECTS AND OTHER LOWER ANIMALS.

### MEANS OF PREVENTION AND CONTROL

1431 - Enemies of the Chinch-bug (*Blissus leucopterus*), Observed in Illinois, U. S. A. (1).— FLINT, W. P., in the *Journal of Economic Entomology*, Vol. XI, No. 5, pp. 415-419. Concord, N. H., 1918.

Up to now it has usually been supposed that the enemies preying on the chinch-bug were only of very limited efficacy in limiting the ravages of that insect. Observations made in Illinois during the recent plague there of this hemipteron (1909-1915) show the contrary however.

The enemies most commonly found feeding on *Blissus leucopterus* in the infested zone were adults and nymphs of the damsel bug (*Reduviolus ferus*), larvae of *Chrysopa* and *Hemerobius*, adult *Blechnus glabratus* and *Bl. pusio*, nymphs and adults of *Pagasa fusca*, larvae of various species of Coccinellidae, nymphs and adults of the flower bug (*Triphleps insidiosus*).

*Casnomia pennsylvanica* feeds on small numbers of the bug, while *Agonoderus pallipes* eats the dead bugs and their moulted skin.

Ants were never seen to attack the living insect.

Judging from the abundance of enemies in the fields infested by *Blissus leucopterus*, and the numbers of the latter eaten by them it is probable that when, after a period of abundance, the development and spread of the hemipteron are stopped by weather conditions, their enemies, with *Eumicrosoma benefica* (parasite of the eggs of *Blissus*), might even prevent the pest from becoming harmful for some years. Thus, over a large area of Illinois, infested by chinch-bugs, no damage was noted in 1917, which is partly due to the abundance of predatory species in the fields. *Red. ferus* and *Pag. fusca* were extraordinarily abundant in fields infested by *Bl. leucopterus* during the summer of 1918.

1432 - Parasites of *Porthetria dispar* (Gipsy Moth) in Spain (2).—MURCIET, R. G., in the *Revista de Montes*, Year XLII, No. 1004, pp. 775-781 + 2 Figs. Madrid, 1918.

The larvae of the gipsy moth (*Porthetria dispar* L.)—known in some districts in Spain under the name of "lagarta" and very injurious to oaks, whose leaves it eats—are spreading alarmingly in the neighbourhood of Madrid (Casa de Campo, El Pardo and Puerta de Hierro).

However, the macrolepidopteron is not exempt from parasites in Spain. The following chalcids, parasitic on its eggs, are described briefly by the author:—

1) *Anastatus bifasciatus*, very abundant and one of the most efficacious enemies of the gipsy moth;

2) *Schedius kuwanæ*; not less efficient than the preceding one;

(1) See R., June 1914, No. 588; R., July, 1915, No. 768. (Ed.)

(2) See R., May, 1911, No. 1568; R., August-September-October, 1911, No. 3025; R., March, 1916, pp. 330-331. (Ed.)



3) *Atoposomoidea ogimae*, not very abundant. In addition there exists in Spain a new species *Tyndarichus* which might perhaps replace *Tynd. navae* among the chalcids parasitic on the eggs of the gipsy moth.<sup>25</sup>

1433 - *Apanteles lacteicolor* and *Meteorus versicolor*, } Hymenoptera  
Parasitic on the Brown-Tail Moth (*Euproctis chrysorrhea*), Imported into  
the United States from Europe (1). — MUESEBECK, C. F. W., in the *Journal of*  
*Agricultural Research*, Vol. XIV, No. 5, pp. 191-206. Washington, July 29, 1918.

In the winter of 1905-1906, as the result of arrangements made by the Washington Bureau of Entomology for the importation from Europe into New England of parasites of *Porthetria dispar* (gipsy moth or bombyx disparate, spongy, zigzag) and *Euproctis chrysorrhea* (brown-tail moth), a large number of winter webs of the second species were sent from Massachusetts to the special laboratory, then at North Saugus, but moved later to Melrose Highlands. This material was placed in special tubes, and, at the beginning of the following spring, were observed in the tubes numerous specimens of *Pteromalus egregius*, a chalcidoid ectoparasite of the wintering brown-tail moth larvae, as well as many specimens of *Monodontomerus aereus* Walker, another chalcidoid which often hibernates in the adult stage in the web of the moth. The moth larvae soon became active. As it seemed unlikely that these larvae should be the hosts of endoparasites they were removed from the tubes and destroyed with the exception of a few which Mr. E. S. H. TITUS, who was then directing the investigations, continued to feed for a certain time. From these larvae were obtained two braconid parasites, one belonging to the genus *Apanteles*, the other to the genus *Meteorus*.

As the result of the discovery made by Mr. TITUS, the moth larvae in webs received in America during succeeding winters were not destroyed when they emerged in spring, but were fed for several weeks in order to rear out any endoparasites they might contain. This method was followed till 1911, when importation was stopped. There were then available for distribution in localities infested by the brown-tail moth about 40 000 cocoons of *Apanteles lacteicolor* and 1 600 of *Meteorus versicolor*. These species are widely distributed in Europe, both having been obtained from moth webs sent from France, Holland, Germany, Russia (especially South Russia), Austria, Switzerland, and Italy. The spread of the parasites has been so rapid that, although only 150 colonies of *Apanteles* and 20 of *Meteorus* have so far been distributed in 135 and 18 localities respectively, no further colonies are required. Both parasites have been recovered from the whole brown-tail moth area either by rearing the moth larvae in spring or by dissecting the hibernating larvae.

The two braconids which hibernate in the brown-tail moth larvae, *A. lacteicolor* and *M. versicolor*, were first described by VIERECK and WESMAEL in 1911 and 1835 respectively. A more complete description of the adults of both species is now given and their biology discussed in detail.

(1) See R. Aug.-Sept.,-Oct. 1911, No. 3025; R. Nov.-Dec., 1911, No. 3252; R. March, 1916, pp. 330-331. (Ed.)

*A. lacteicolor* is of great importance as a means of control. It is such an efficient parasite that 20 to 25 % of brown-tail moth larvae in a web are often attacked. Its value is increased by the fact that, in America, it has several generations a year and is a more or less important parasite of the gipsy moth and other native injurious species. Moreover, *A. lacteicolor* destroys its hosts in their early stages, preventing them from doing any serious damage by considerably delaying their development. The weak point in the life cycle of *A. lacteicolor* is its evident dependence on the brown-tail moth for hibernation. The moth is now beginning to disappear so that *A. lacteicolor* is becoming gradually less abundant, thus materially reducing its parasitism on *Porth. dispar* and other native hosts.

*M. versicolor* is much inferior to *A. lacteicolor* as a parasite of the hibernating brown-tail moth larvae of which it only destroys a small percentage. On some occasions cocoons of *M. versicolor* have been found in enormous numbers in serious brown-tail moth infestations, but these cases are rare. Moreover, parasitism on the almost full-grown brown-tail moth larvae is slight, and that upon native larvae appears almost insignificant. The slight importance of this parasite as compared with *A. lacteicolor* is probably largely due to its dependence on the brown-tail moth for hibernation, and the fact that it, in its turn, is exposed to attack from various parasites. Another factor reducing the importance of this *Meteorus* is the frequent failure of the larvae to transform to pupae when they have spun cocoons. When *A. lacteicolor* larvae occur in the same hibernating brown-tail moth larvae as *M. versicolor* they cause the death of these latter.

INSECTS, ETC  
INJURIOUS  
TO VARIOUS  
CROPS

1434 - The Control of *Cylas formicarius*, a Coleopteron Attacking Sweet Potatoes, at Porto Rico (1). — SMYTH, E. G., in the *Revista de Agricultura de Puerto Rico*, Vol. I, No. 3, pp. 136-139. San Juan, 1918

At Porto Rico *Cylas formicarius* ("gorgojo de la batata" or "gorgojo de la raíz de la batata"), which has been present in the island for a long time, sometimes destroys more than 75 % of the sweet potato crop and makes it impossible to continue cultivating it. The injury is done by the larva and the adult which hollow galleries in the root, making it unfit for consumption.

When new plantations are formed it is important to be certain that the insect is neither present in the soil nor introduced in the cuttings used. If it be doubtful that the plants from which cuttings are to be made are free from the parasite cuttings must be made from healthy plants which have been previously fumigated with carbon bisulphide and placed in a nursery at a distance from infested plantations.

It is very difficult to free a heavily infested, large sweet potato plantation from the insect. The only method is to harvest all the tubers as soon as the pest is discovered; the longer this is delayed the more difficult will

(1) See R. March, 1911, No. 1058; R. April, 1911, No. 1319; R. Jan., 1916, No. 120; R. Aug., 1918, No. 936 (Ed.)

it be to destroy the insect completely. When harvesting the roots care must be taken to leave no infested ones on the ground or the crop next grown in the same soil will be infected. Potatoes suitable for sale must be immediately removed from the field, and those to be used for propagation fumigated without delay. Attacked tubers which have no market value may be first boiled to kill the adult and larval stages of the insects and then fed to stock. Tubers which are useless even as cattle-food should be burnt or buried deeply, care being taken to leave none of them above soil. All the stems should, at the same time, be heaped up and given to stock, or pigs may be turned into the field till all the stems are eaten. By no means should pigs be turned into the field as soon as the marketable potatoes have been sold. The tubers infested by the insects, which are precisely those which should be destroyed are refused by pigs and, being left on the ground, cause new infestation.

1435 - *Pectinophora gossypiella*, a Microlepidopteron Injurious to Cotton in Egypt (1). — See No. 1356 of this Review.

1436 - Observations on the Coleopteron *Lasioderma serricorne* and the Lepidopteron *Setomorpha margalaestriata*, Injurious to Tobacco, in the Dutch East Indies (2). — KEUCHENIUS, P. E., in the *Mededeelingen van het Besoekisch Proefstation*, No. 26, pp. 1-56 + 1 Plate. 1917.

Publication of the author's work on *Lasioderma serricorne* ("tabaks-boeboek") and *Setomorpha margalaestriata* ("tabaksmot") and the means of controlling them.

*L. serricorne* is attracted to lamp-light, and this property may be used in controlling it; molasses also attracts this insect. In tobacco the adult lives 25 days; the female produces about 30 eggs. About 1 ½ months are required for the insect to become full grown. The incubation of the eggs requires from 4 to 14 days; the larval stage lasts from 30 to 60 days and the pupal stage about 12 days. This *Lasioderma* is omnivorous, it attacks many products, the finest qualities of tobacco being chosen by preference. By placing the insect in a room heated to 60°C. for 20 minutes, all stages of its development are killed. A temperature of about 8°C. for 7 days has the same effect. A temperature of about 0°C. for 5 consecutive days does not kill the eggs, but kills the larvae, pupae and adults. Experiments made with low temperatures have shown that both eggs and larvae of the insect can survive a moderately cold winter.

The following observations regarding *Set. margalaestriata* are given by the author: — This lepidopteron occurs in Java and Sumatra. Besides tobacco it attacks tobacco seeds, clothes, leather and dried coca leaves. The female lays from 100-150 eggs; the life cycle requires from 40-60 days.

(1) See R., Nov. 1918, No. 1309.

(2) See R., Nov. 1914, No. 1081; R. May 1916, No. 590; R. June 1916, No. 711; R. Dec. 1917, No. 1261. (Ed.)

The egg hatches in from 7 to 8 days, the larval stage lasts from 3 to 5 weeks and the pupal stage 14 days. A temperature of 42°C for 5 hours kills the insect in all its stages; a temperature of 0°C. for 5 days has the same effect. It may thus be concluded that the insect could not survive the winter in a temperate region. The author mentions a few means of control and discusses the results obtained with them. As measures to take for avoiding infection all the tobacco barns should be paved with concrete, the barns should be disinfected and all the tobacco or other products liable to attack and intended for export should be fumigated with carbon bisulphide. The disinfection should take place 5 days before embarking, so that the carbon bisulphide can escape completely. The Dock and Shipping Companies must be forbidden to place disinfected goods along by infected goods. Tobacco destined to the Colonies should be disinfected in Holland and in the other exporting countries.

1437 - *Clytus devastator*, a Coleopteron Injurious to Citrus and Other Plants, in Cuba and Florida. — BACK, E. A., in the *Journal of Economic Entomology*, Vol. XI, No. 5, pp. 411-414 + Plate. Concord, N. H., 1918.

The cerambycid beetle *Clytus devastator*, first described in 1836 by DELAPORTE DE CASTELNAU and GORY as a serious pest of lemons in Cuba, has, of recent years, been also reported from Florida as a pest of citrus and other plants. In Cuba, specimens of the insect have been bred out at Cayamas in 1910 from Cuban mahogany while other specimens have been taken at Central Constancia. The beetle has been observed in the following localities between 1903 to 1910: — Palm Beach, Key West, Paradise Key, Chase and Perico Island, near Anna Maria Key at the entry to Pampa bay. The specimens from Chase were bred out from the pomegranate tree; that of Paradise Key was taken flying. Although at first recorded as a dangerous pest of *Citrus* in Cuba, the insect was only bred out from *Citrus* in the spring of 1910 in Perico Island, when its larvae caused serious damage to the orange trees by hollowing out galleries in the trunk and branches. According to E. A. SCHWARZ its favourite host is *Rhizophora Mangle*.

The author calls attention to this beetle which might seriously harm the Florida citrus trade.

1438 - Pests of Stored Food-stuff, in Java. — KEUCHENIUS P. B., in *Teymannia*, Year XXIX, Pt. 4, pp. 216-221 Batavia, 1915.

The author has drawn up a list of the pests recorded in the foodstuffs stored in Eastern Java: — *Lasioderma serricorne*, *Scotomorpha marginalae-striata*, *Araucocerus fasciculatus*, *Rhizophorha dominica*, *Tenebrioides mauritanicus*, *Silvanus surinamensis*, *Calandra oryzae*, *Tribolium castaneum*, *Gonocephalum hoffmannseggii*, *Thaneroclerus buquet*, *Necrobia rufipes*, *Laeophloeus* sp., *Carpophilus* spp., *Thagora figurana*, etc.

Many of these pests are not very specialised in their choice of food as the same species can often be found in different foodstuffs. Although some species are not always directly injurious to the product — some of them may even be useful, e. g., *Necrobia rufipes* and *Thaneroclerus buquet* which

drive out all the other pests present in the product — they always reduce its value.

The author discusses methods of disinfection. Treatment with steam or low temperatures is always expensive in the East Indies; X rays can only be used where electric current is cheap; carbon tetrachloride is less advisable than carbon bisulphide on account of its price; prussic acid gas, so very poisonous, can only be used for disinfecting loose products; the disadvantages of this gas are: — the great danger it presents to those applying it, the special glass generators required for preparing it, the rapid loss of its toxicity as it is so easily absorbed by the water contained in the products; sulphur dioxide which besides not having a very strong action, has a bad effect on many products (tobacco, cacao, flour, etc.).

In many cases, a high temperature can be used for disinfection especially if the plantation has a drier. If this last method cannot be used, treatment with carbon bisulphide is advisable. This has so far given the best results and has no effect on the quality of the following products: — hybrid coffee, cacao, tobacco, groundnuts, flour, copra, maize, rice and coca; it produces an insignificant change of shade in the berries of *Coffea robusta*. To disinfect a cubic metre in 24 hours 185 cc. are required, and for the same volume in 48 hours 100 cc. suffices, and in 72 hours 80 cc. The method consists in placing the material to be disinfected into a hermetically closed space in which, at the height of the ceiling, saucers containing carbon bisulphide are placed.

[1438]